

```
!pip install ultralytics==8.0.20
```

```
from IPython import display  
display.clear_output()
```

```
import ultralytics  
ultralytics.checks()
```

```
Ultralytics YOLOv8.0.20 🚀 Python-3.10.6 torch-2.0.1+cu118 CUDA:0  
(Tesla V100-SXM2-16GB, 16151MiB)  
Setup complete ✅ (2 CPUs, 12.7 GB RAM, 24.3/78.2 GB disk)
```

```
!pip install roboflow
```

```
from roboflow import Roboflow  
rf = Roboflow(api_key="RryrqjLPNrma5c1REwoU")  
project = rf.workspace("bangor-university").project("yolov8-lj3oc")  
dataset = project.version(1).download("yolov8")  
# tmr gul
```

```
Collecting roboflow
```

```
  Downloading roboflow-1.1.2-py3-none-any.whl (57 kB)
```

```
_____ 57.4/57.4 kB 1.6 MB/s eta
```

```
0:00:00
```

```
roboflow)
```

```
  Downloading certifi-2022.12.7-py3-none-any.whl (155 kB)
```

```
_____ 155.3/155.3 kB 6.7 MB/s eta
```

```
0:00:00
```

```
Requirement already satisfied: chardet==4.0.0 in
```

```
/usr/local/lib/python3.10/dist-packages (from roboflow) (4.0.0)
```

```
Collecting cycler==0.10.0 (from roboflow)
```

```
  Downloading cycler-0.10.0-py2.py3-none-any.whl (6.5 kB)
```

```
Collecting idna==2.10 (from roboflow)
```

```
  Downloading idna-2.10-py2.py3-none-any.whl (58 kB)
```

```
_____ 58.8/58.8 kB 8.6 MB/s eta
```

```
0:00:00
```

```
Requirement already satisfied: kiwisolver>=1.3.1 in
```

```
/usr/local/lib/python3.10/dist-packages (from roboflow) (1.4.4)
```

```
Requirement already satisfied: matplotlib in
```

```
/usr/local/lib/python3.10/dist-packages (from roboflow) (3.7.1)
```

```
Requirement already satisfied: numpy>=1.18.5 in
```

```
/usr/local/lib/python3.10/dist-packages (from roboflow) (1.22.4)
```

```
Requirement already satisfied: opencv-python>=4.1.2 in
```

```
/usr/local/lib/python3.10/dist-packages (from roboflow) (4.7.0.72)
```

```
Requirement already satisfied: Pillow>=7.1.2 in
```

```
/usr/local/lib/python3.10/dist-packages (from roboflow) (8.4.0)
```

```
Collecting pyparsing==2.4.7 (from roboflow)
```

```
  Downloading pyparsing-2.4.7-py2.py3-none-any.whl (67 kB)
```

```
_____ 67.8/67.8 kB 9.1 MB/s eta
```

```
0:00:00
```

```

ent already satisfied: python-dateutil in
/usr/local/lib/python3.10/dist-packages (from roboflow) (2.8.2)
Collecting python-dotenv (from roboflow)
  Downloading python_dotenv-1.0.0-py3-none-any.whl (19 kB)
Requirement already satisfied: requests in
/usr/local/lib/python3.10/dist-packages (from roboflow) (2.27.1)
Requirement already satisfied: six in /usr/local/lib/python3.10/dist-
packages (from roboflow) (1.16.0)
Collecting supervision (from roboflow)
  Downloading supervision-0.12.0-py3-none-any.whl (48 kB)


---


48.5/48.5 kB 7.0 MB/s eta
0:00:00
ent already satisfied: urllib3>=1.26.6 in
/usr/local/lib/python3.10/dist-packages (from roboflow) (1.26.16)
Collecting wget (from roboflow)
  Downloading wget-3.2.zip (10 kB)
  Preparing metadata (setup.py) ... ent already satisfied:
tqdm>=4.41.0 in /usr/local/lib/python3.10/dist-packages (from
roboflow) (4.65.0)
Requirement already satisfied: PyYAML>=5.3.1 in
/usr/local/lib/python3.10/dist-packages (from roboflow) (6.0.1)
Collecting requests-toolbelt (from roboflow)
  Downloading requests_toolbelt-1.0.0-py2.py3-none-any.whl (54 kB)


---


54.5/54.5 kB 8.0 MB/s eta
0:00:00
ent already satisfied: contourpy>=1.0.1 in
/usr/local/lib/python3.10/dist-packages (from matplotlib->roboflow)
(1.1.0)
Requirement already satisfied: fonttools>=4.22.0 in
/usr/local/lib/python3.10/dist-packages (from matplotlib->roboflow)
(4.41.0)
Requirement already satisfied: packaging>=20.0 in
/usr/local/lib/python3.10/dist-packages (from matplotlib->roboflow)
(23.1)
Requirement already satisfied: charset-normalizer~=2.0.0 in
/usr/local/lib/python3.10/dist-packages (from requests->roboflow)
(2.0.12)
Requirement already satisfied: opencv-python-
headless<5.0.0.0,>=4.8.0.74 in /usr/local/lib/python3.10/dist-packages
(from supervision->roboflow) (4.8.0.74)
Building wheels for collected packages: wget
  Building wheel for wget (setup.py) ... e=wget-3.2-py3-none-any.whl
size=9657
sha256=fc7aca9717fde732c83df62aa2a6592d3c1f4471f41d335451b10f4377eb0f2
d
  Stored in directory:
/root/.cache/pip/wheels/8b/f1/7f/5c94f0a7a505ca1c81cd1d9208ae2064675d9
7582078e6c769
Successfully built wget

```

Installing collected packages: wget, python-dotenv, pyparsing, idna, cyclcr, certifi, supervision, requests-toolbelt, roboflow

Attempting uninstall: pyparsing

Found existing installation: pyparsing 3.1.0

Uninstalling pyparsing-3.1.0:

Successfully uninstalled pyparsing-3.1.0

Attempting uninstall: idna

Found existing installation: idna 3.4

Uninstalling idna-3.4:

Successfully uninstalled idna-3.4

Attempting uninstall: cyclcr

Found existing installation: cyclcr 0.11.0

Uninstalling cyclcr-0.11.0:

Successfully uninstalled cyclcr-0.11.0

Attempting uninstall: certifi

Found existing installation: certifi 2023.5.7

Uninstalling certifi-2023.5.7:

Successfully uninstalled certifi-2023.5.7

Successfully installed certifi-2022.12.7 cyclcr-0.10.0 idna-2.10
pyparsing-2.4.7 python-dotenv-1.0.0 requests-toolbelt-1.0.0 roboflow-
1.1.2 supervision-0.12.0 wget-3.2

```
{"pip_warning":{"packages":["certifi","cyclcr","idna","pyparsing"]}}
```

loading Roboflow workspace...

loading Roboflow project...

Dependency ultralytics==8.0.134 is required but found version=8.0.20,
to fix: `pip install ultralytics==8.0.134`

Downloading Dataset Version Zip in yolov8-1 to yolov8: 100% [1337743 /
1337743] bytes

Extracting Dataset Version Zip to yolov8-1 in yolov8:: 100%|
██████████| 125/125 [00:00<00:00, 4364.59it/s]

```
!pip install ultralytics==8.0.20
```

```
from IPython import display  
display.clear_output()
```

```
import ultralytics  
ultralytics.checks()
```

Ultralytics YOLOv8.0.20 🚀 Python-3.10.6 torch-2.0.1+cu118 CUDA:0
(Tesla V100-SXM2-16GB, 16151MiB)
Setup complete ✅ (2 CPUs, 12.7 GB RAM, 24.3/78.2 GB disk)

```
from ultralytics import YOLO
```

```
from IPython.display import display, Image
```

```
%cd /content/yolov8-1
```

```
!yolo task=detect mode=train model=yolov8s.pt data= '/content/yolov8-1/data.yaml' epochs=10000 plots=True
```

```
/content/yolov8-1
```

```
Downloading
```

```
https://github.com/ultralytics/assets/releases/download/v0.0.0/yolov8s.pt to yolov8s.pt...
```

```
100% 21.5M/21.5M [00:00<00:00, 166MB/s]
```

```
Ultralytics YOLOv8.0.20 🚀 Python-3.10.6 torch-2.0.1+cu118 CUDA:0
```

```
(Tesla V100-SXM2-16GB, 16151MiB)
```

```
yolo/engine/trainer: task=detect, mode=train, model=yolov8s.yaml,  
data=/content/yolov8-1/data.yaml, epochs=10000, patience=50, batch=16,  
imgsz=640, save=True, cache=False, device=, workers=8, project=None,  
name=None, exist_ok=False, pretrained=False, optimizer=SGD,  
verbose=True, seed=0, deterministic=True, single_cls=False,  
image_weights=False, rect=False, cos_lr=False, close_mosaic=10,  
resume=False, overlap_mask=True, mask_ratio=4, dropout=False,  
val=True, save_json=False, save_hybrid=False, conf=0.001, iou=0.7,  
max_det=300, half=False, dnn=False, plots=True,  
source=ultralytics/assets/, show=False, save_txt=False,  
save_conf=False, save_crop=False, hide_labels=False, hide_conf=False,  
vid_stride=1, line_thickness=3, visualize=False, augment=False,  
agnostic_nms=False, classes=None, retina_masks=False, boxes=True,  
format=torchscript, keras=False, optimize=False, int8=False,  
dynamic=False, simplify=False, opset=17, workspace=4, nms=False,  
lr0=0.01, lrf=0.01, momentum=0.937, weight_decay=0.001,  
warmup_epochs=3.0, warmup_momentum=0.8, warmup_bias_lr=0.1, box=7.5,  
cls=0.5, dfl=1.5, fl_gamma=0.0, label_smoothing=0.0, nbs=64,  
hsv_h=0.015, hsv_s=0.7, hsv_v=0.4, degrees=0.0, translate=0.1,  
scale=0.5, shear=0.0, perspective=0.0, flipud=0.0, fliplr=0.5,  
mosaic=1.0, mixup=0.0, copy_paste=0.0, cfg=None, v5loader=False,  
save_dir=runs/detect/train
```

```
Downloading https://ultralytics.com/assets/Arial.ttf to
```

```
/root/.config/Ultralytics/Arial.ttf...
```

```
100% 755k/755k [00:00<00:00, 17.1MB/s]
```

```
2023-07-25 20:41:55.288504: I
```

```
tensorflow/core/platform/cpu_feature_guard.cc:182] This TensorFlow  
binary is optimized to use available CPU instructions in performance-  
critical operations.
```

```
To enable the following instructions: AVX2 FMA, in other operations,  
rebuild TensorFlow with the appropriate compiler flags.
```

```
2023-07-25 20:41:56.229400: W
```

```
tensorflow/compiler/tf2tensorrt/utils/py_utils.cc:38] TF-TRT Warning:  
Could not find TensorRT
```

```
Overriding model.yaml nc=80 with nc=3
```

```
from n      params  module
```

arguments				
0	-1 1	928	ultralalytics.nn.modules.Conv	
[3, 32, 3, 2]				
1	-1 1	18560	ultralalytics.nn.modules.Conv	
[32, 64, 3, 2]				
2	-1 1	29056	ultralalytics.nn.modules.C2f	
[64, 64, 1, True]				
3	-1 1	73984	ultralalytics.nn.modules.Conv	
[64, 128, 3, 2]				
4	-1 2	197632	ultralalytics.nn.modules.C2f	
[128, 128, 2, True]				
5	-1 1	295424	ultralalytics.nn.modules.Conv	
[128, 256, 3, 2]				
6	-1 2	788480	ultralalytics.nn.modules.C2f	
[256, 256, 2, True]				
7	-1 1	1180672	ultralalytics.nn.modules.Conv	
[256, 512, 3, 2]				
8	-1 1	1838080	ultralalytics.nn.modules.C2f	
[512, 512, 1, True]				
9	-1 1	656896	ultralalytics.nn.modules.SPPF	
[512, 512, 5]				
10	-1 1	0		
torch.nn.modules.upsampling.Upsample			[None, 2, 'nearest']	
11	[-1, 6] 1	0	ultralalytics.nn.modules.Concat	
[1]				
12	-1 1	591360	ultralalytics.nn.modules.C2f	
[768, 256, 1]				
13	-1 1	0		
torch.nn.modules.upsampling.Upsample			[None, 2, 'nearest']	
14	[-1, 4] 1	0	ultralalytics.nn.modules.Concat	
[1]				
15	-1 1	148224	ultralalytics.nn.modules.C2f	
[384, 128, 1]				
16	-1 1	147712	ultralalytics.nn.modules.Conv	
[128, 128, 3, 2]				
17	[-1, 12] 1	0	ultralalytics.nn.modules.Concat	
[1]				
18	-1 1	493056	ultralalytics.nn.modules.C2f	
[384, 256, 1]				
19	-1 1	590336	ultralalytics.nn.modules.Conv	
[256, 256, 3, 2]				
20	[-1, 9] 1	0	ultralalytics.nn.modules.Concat	
[1]				
21	-1 1	1969152	ultralalytics.nn.modules.C2f	
[768, 512, 1]				
22	[15, 18, 21] 1	2117209	ultralalytics.nn.modules.Detect	
[3, [128, 256, 512]]				

Model summary: 225 layers, 11136761 parameters, 11136745 gradients, 28.7 GFLOPs

Transferred 349/355 items from pretrained weights
optimizer: SGD(lr=0.01) with parameter groups 57 weight(decay=0.0), 64 weight(decay=0.001), 63 bias
train: Scanning /content/yolov8-1/train/labels... 52 images, 0 backgrounds, 0 corrupt: 100% 52/52 [00:00<00:00, 979.22it/s]
train: New cache created: /content/yolov8-1/train/labels.cache
augmentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01, blur_limit=(3, 7)), ToGray(p=0.01), CLAHE(p=0.01, clip_limit=(1, 4.0), tile_grid_size=(8, 8))
val: Scanning /content/yolov8-1/test/labels... 6 images, 0 backgrounds, 0 corrupt: 100% 6/6 [00:00<00:00, 1111.32it/s]
val: New cache created: /content/yolov8-1/test/labels.cache
Image sizes 640 train, 640 val
Using 2 dataloader workers
Logging results to runs/detect/train
Starting training for 10000 epochs...

	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
--	-------	---------	----------	----------	----------	-----------

Size

	1/10000	4.37G	2.303	4.713	0.9862	65
--	---------	-------	-------	-------	--------	----

640: 100% 4/4 [00:15<00:00, 3.93s/it]

/usr/local/lib/python3.10/dist-packages/torch/optim/lr_scheduler.py:13

9: UserWarning: Detected call of `lr_scheduler.step()` before `optimizer.step()`. In PyTorch 1.1.0 and later, you should call them in the opposite order: `optimizer.step()` before `lr_scheduler.step()`. Failure to do this will result in PyTorch skipping the first value of the learning rate schedule. See more details at <https://pytorch.org/docs/stable/optim.html#how-to-adjust-learning-rate>

warnings.warn("Detected call of `lr_scheduler.step()` before `optimizer.step()`. "

	Class	Images	Instances	Box(P	R
--	-------	--------	-----------	-------	---

mAP50 mAP50-95): 100% 1/1 [00:03<00:00, 3.95s/it]

	all	6	100	0.00475	0.0476
--	-----	---	-----	---------	--------

0.00936	0.00446				
---------	---------	--	--	--	--

	microcrack	6	1	0	0
--	------------	---	---	---	---

0	0				
---	---	--	--	--	--

	porosity	6	8	0	0
--	----------	---	---	---	---

0	0				
---	---	--	--	--	--

	unmelted particle	6	91	0.0142	0.143
--	-------------------	---	----	--------	-------

0.0281	0.0134				
--------	--------	--	--	--	--

	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
--	-------	---------	----------	----------	----------	-----------

Size

	2/10000	4.96G	2.308	4.638	1.029	70
--	---------	-------	-------	-------	-------	----

640: 100% 4/4 [00:07<00:00, 1.78s/it]

	Class	Images	Instances	Box(P	R
--	-------	--------	-----------	-------	---

```

mAP50 mAP50-95): 100% 1/1 [00:00<00:00, 4.11it/s]
      all          6          100      0.00368      0.0366
0.00772      0.0036
      microcrack      6          1          0          0
0          0
      porosity      6          8          0          0
0          0
      unmelted particle      6          91      0.011      0.11
0.0232      0.0108

```

```

      Epoch      GPU_mem      box_loss      cls_loss      dfl_loss      Instances
Size
      3/10000      5.7G      2.319      4.885      1.006      39
640: 100% 4/4 [00:08<00:00, 2.22s/it]
      Class      Images      Instances      Box(P      R
mAP50 mAP50-95): 100% 1/1 [00:00<00:00, 4.62it/s]
      all          6          100      0.174      0.122
0.129      0.109
      microcrack      6          1          0          0
0          0
      porosity      6          8      0.5      0.125
0.344      0.309
      unmelted particle      6          91      0.0235      0.242
0.0432      0.019

```

```

      Epoch      GPU_mem      box_loss      cls_loss      dfl_loss      Instances
Size
      4/10000      5.71G      2.022      2.895      0.9505      107
640: 100% 4/4 [00:08<00:00, 2.11s/it]
      Class      Images      Instances      Box(P      R
mAP50 mAP50-95): 100% 1/1 [00:00<00:00, 4.47it/s]
      all          6          100      0.577      0.243
0.364      0.173
      microcrack      6          1          0          0
0          0
      porosity      6          8          1      0.25
0.576      0.358
      unmelted particle      6          91      0.731      0.479
0.516      0.162

```

```

      Epoch      GPU_mem      box_loss      cls_loss      dfl_loss      Instances
Size
      5/10000      5.71G      2.16      2.342      0.9586      45
640: 100% 4/4 [00:07<00:00, 1.81s/it]
      Class      Images      Instances      Box(P      R
mAP50 mAP50-95): 100% 1/1 [00:00<00:00, 4.63it/s]
      all          6          100      0.724      0.23
0.265      0.117
      microcrack      6          1          1          0
0          0

```

0.338	porosity	6	8	0.473	0.25
	0.222				
0.458	unmelted particle	6	91	0.699	0.44
	0.128				

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
640:	6/10000	5.71G	2.003	2.068	0.9292	38
100%	4/4	[00:08<00:00, 2.19s/it]				
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.40it/s]			
	all	6	100	0.264	0.165	
0.25	0.134					
0	microcrack	6	1	0	0	
	0					
0.346	porosity	6	8	0.157	0.375	
	0.242					
0.403	unmelted particle	6	91	0.635	0.121	
	0.16					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
640:	7/10000	5.71G	2.011	1.83	0.9618	157
100%	4/4	[00:08<00:00, 2.17s/it]				
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.46it/s]			
	all	6	100	0.701	0.246	
0.265	0.132					
0	microcrack	6	1	1	0	
	0					
0.417	porosity	6	8	0.537	0.375	
	0.279					
0.378	unmelted particle	6	91	0.564	0.363	
	0.116					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
640:	8/10000	5.71G	2.079	1.699	0.9291	103
100%	4/4	[00:07<00:00, 1.81s/it]				
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.47it/s]			
	all	6	100	0.803	0.217	
0.245	0.134					
0	microcrack	6	1	1	0	
	0					
0.442	porosity	6	8	0.946	0.375	
	0.328					
0.293	unmelted particle	6	91	0.465	0.275	
	0.0733					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
9/10000		5.71G	1.867	1.728	0.9119	72
640: 100%	4/4	[00:08<00:00, 2.15s/it]				
mAP50	Class	Images	Instances	Box(P	R	
mAP50-95): 100%	1/1	[00:00<00:00, 4.56it/s]				
0.364	all	6	100	0.893	0.283	
0	0.2					
	microcrack	6	1	1	0	
0.505	0					
	porosity	6	8	0.965	0.375	
0.586	0.379					
	unmelted particle	6	91	0.715	0.473	
	0.222					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
10/10000		5.71G	2.03	1.622	0.9169	105
640: 100%	4/4	[00:08<00:00, 2.07s/it]				
mAP50	Class	Images	Instances	Box(P	R	
mAP50-95): 100%	1/1	[00:00<00:00, 3.24it/s]				
0.306	all	6	100	0.821	0.274	
0	0.152					
	microcrack	6	1	1	0	
0.577	0					
	porosity	6	8	0.923	0.5	
0.341	0.368					
	unmelted particle	6	91	0.539	0.321	
	0.0869					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
11/10000		5.71G	2.162	1.43	0.9397	87
640: 100%	4/4	[00:07<00:00, 1.81s/it]				
mAP50	Class	Images	Instances	Box(P	R	
mAP50-95): 100%	1/1	[00:00<00:00, 4.74it/s]				
0.382	all	6	100	0.857	0.322	
0	0.178					
	microcrack	6	1	1	0	
0.649	0					
	porosity	6	8	1	0.469	
0.498	0.393					
	unmelted particle	6	91	0.57	0.496	
	0.14					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
12/10000		6.73G	1.893	1.579	0.9014	92
640: 100%	4/4	[00:09<00:00, 2.26s/it]				
	Class	Images	Instances	Box(P	R	

```

mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.51it/s]
          all          6          100          0.762          0.351
0.378          0.203
          microcrack          6          1          1          0
0          0
          porosity          6          8          0.649          0.625
0.641          0.44
          unmelted particle          6          91          0.637          0.429
0.493          0.169

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
    13/10000        6.73G        2.127        1.531        0.9202         80
640: 100% 4/4 [00:08<00:00, 2.02s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 3.07it/s]
          all          6          100          0.774          0.285
0.319          0.181
          microcrack          6          1          1          0
0          0
          porosity          6          8          1          0.592
0.707          0.464
          unmelted particle          6          91          0.323          0.264
0.251          0.0807

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
    14/10000        6.74G        2.186        1.492        0.9232         63
640: 100% 4/4 [00:07<00:00, 1.82s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.56it/s]
          all          6          100          0.776          0.355
0.574          0.284
          microcrack          6          1          1          0
0.497          0.149
          porosity          6          8          0.684          0.625
0.69          0.475
          unmelted particle          6          91          0.645          0.44
0.534          0.228

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
    15/10000        6.74G        1.951        1.386        0.9068         68
640: 100% 4/4 [00:09<00:00, 2.30s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.46it/s]
          all          6          100          0.785          0.32
0.463          0.243
          microcrack          6          1          1          0
0.142          0.0426

```

0.676	porosity	6	8	0.585	0.625
	0.47				
0.572	unmelted particle	6	91	0.771	0.334
	0.216				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
16/10000	6.74G	2.035	1.572	0.8835	82
640: 100% 4/4	[00:07<00:00,	1.96s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	3.29it/s]	
	all	6	100	0.807	0.409
0.399	0.186				
	microcrack	6	1	1	0
0	0				
0.766	porosity	6	8	1	0.59
	0.423				
0.432	unmelted particle	6	91	0.42	0.637
	0.135				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
17/10000	6.74G	1.99	1.356	0.9011	104
640: 100% 4/4	[00:07<00:00,	1.91s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.74it/s]	
	all	6	100	0.824	0.403
0.434	0.243				
	microcrack	6	1	1	0
0	0				
0.765	porosity	6	8	0.749	0.75
	0.518				
0.537	unmelted particle	6	91	0.723	0.459
	0.211				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
18/10000	6.74G	2.155	1.503	0.98	36
640: 100% 4/4	[00:08<00:00,	2.17s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.52it/s]	
	all	6	100	0.722	0.345
0.374	0.223				
	microcrack	6	1	1	0
0.0262	0.0168				
0.79	porosity	6	8	0.682	0.75
	0.536				
0.305	unmelted particle	6	91	0.483	0.286
	0.116				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
19/10000	6.74G	2.214	1.452	0.9462	45
640: 100% 4/4 [00:07<00:00, 1.90s/it]					
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 2.96it/s]		
	all	6	100	0.804	0.41
0.435	0.234				
	microcrack	6	1	1	0
0.0711	0.0355				
	porosity	6	8	0.594	0.733
0.598	0.42				
	unmelted particle	6	91	0.819	0.497
0.636	0.248				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
20/10000	6.74G	2.2	1.602	0.9352	56
640: 100% 4/4 [00:07<00:00, 1.82s/it]					
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.80it/s]		
	all	6	100	0.715	0.233
0.287	0.181				
	microcrack	6	1	1	0
0	0				
	porosity	6	8	0.819	0.5
0.654	0.474				
	unmelted particle	6	91	0.324	0.198
0.208	0.0696				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
21/10000	7.83G	2.171	1.564	0.9561	55
640: 100% 4/4 [00:09<00:00, 2.25s/it]					
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.63it/s]		
	all	6	100	0.56	0.364
0.324	0.184				
	microcrack	6	1	1	0
0	0				
	porosity	6	8	0.209	0.75
0.643	0.448				
	unmelted particle	6	91	0.471	0.342
0.328	0.105				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
22/10000	7.83G	2.096	1.564	0.9832	58
640: 100% 4/4 [00:07<00:00, 1.94s/it]					
	Class	Images	Instances	Box(P	R

```

mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 3.12it/s]
          all          6          100          0.773          0.394
0.424      0.224
          microcrack          6          1          1          0
0.166      0.0498
          porosity          6          8          0.948          0.625
0.75      0.501
          unmelted particle          6          91          0.37          0.556
0.357      0.122

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  23/10000      7.83G        2.075        1.802        0.9376         86
640: 100% 4/4 [00:07<00:00, 1.91s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.74it/s]
          all          6          100          0.837          0.377
0.435      0.194
          microcrack          6          1          1          0
0.0622      0.00622
          porosity          6          8          0.839          0.75
0.699      0.395
          unmelted particle          6          91          0.671          0.381
0.542      0.181

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  24/10000      7.83G        1.992        1.556        0.9541         59
640: 100% 4/4 [00:08<00:00, 2.17s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.44it/s]
          all          6          100          0.767          0.355
0.355      0.191
          microcrack          6          1          1          0
0          0
          porosity          6          8          0.561          0.75
0.67      0.435
          unmelted particle          6          91          0.741          0.314
0.394      0.138

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  25/10000      7.83G        2.293        3.915        0.9859        119
640: 100% 4/4 [00:07<00:00, 1.82s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.43it/s]
          all          6          100          0.904          0.289
0.348      0.192
          microcrack          6          1          1          0
0          0

```

0.676	porosity	6	8	0.854	0.735
0.444					
0.368	unmelted particle	6	91	0.858	0.133
0.131					

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
26/10000	7.83G	2.242	1.882	0.9672	132
640: 100% 4/4	[00:08<00:00, 2.11s/it]				
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.85it/s]		
	all	6	100	0.762	0.386
0.346	0.203				
	microcrack	6	1	1	0
0	0				
0.644	porosity	6	8	0.663	0.75
0.472					
0.394	unmelted particle	6	91	0.623	0.407
0.136					

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
27/10000	7.83G	2.162	1.734	0.9455	89
640: 100% 4/4	[00:09<00:00, 2.25s/it]				
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.54it/s]		
	all	6	100	0.64	0.333
0.648	0.314				
	microcrack	6	1	1	0
0.995	0.373				
	porosity	6	8	0.266	0.75
0.644	0.456				
0.304	unmelted particle	6	91	0.655	0.25
0.114					

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
28/10000	7.83G	2.171	1.991	0.9516	81
640: 100% 4/4	[00:07<00:00, 1.80s/it]				
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.53it/s]		
	all	6	100	0.711	0.356
0.408	0.192				
	microcrack	6	1	1	0
0.199	0.0443				
	porosity	6	8	0.384	0.75
0.697	0.426				
0.328	unmelted particle	6	91	0.749	0.319
0.104					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
29/10000		7.83G	2.293	1.413	0.9769	58
640: 100%	4/4	[00:08<00:00, 2.04s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.41it/s]			
		all	6	100	0.852	0.325
0.354	0.18	microcrack	6	1	1	0
0	0	porosity	6	8	1	0.616
0.735	0.421	unmelted particle	6	91	0.557	0.359
0.327	0.119					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
30/10000		7.83G	2.131	1.648	0.9865	77
640: 100%	4/4	[00:08<00:00, 2.11s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.78it/s]			
		all	6	100	0.758	0.356
0.42	0.198	microcrack	6	1	1	0
0.142	0.0426	porosity	6	8	0.446	0.75
0.68	0.402	unmelted particle	6	91	0.828	0.317
0.439	0.15					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
31/10000		7.83G	1.936	1.73	0.9228	56
640: 100%	4/4	[00:07<00:00, 1.88s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.66it/s]			
		all	6	100	0.777	0.296
0.348	0.169	microcrack	6	1	1	0
0.111	0.0221	porosity	6	8	0.754	0.625
0.652	0.383	unmelted particle	6	91	0.577	0.264
0.283	0.103					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
32/10000		7.83G	2.151	1.292	0.944	70
640: 100%	4/4	[00:08<00:00, 2.23s/it]				
		Class	Images	Instances	Box(P	R

```

mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.60it/s]
          all          6          100          0.798          0.358
0.554      0.224
          microcrack          6          1          1          0
0.497      0.0995
          porosity          6          8          0.563          0.75
0.646      0.383
          unmelted particle          6          91          0.831          0.324
0.519      0.189

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  33/10000      7.83G        2.08        1.569        0.9406        110
640: 100% 4/4 [00:08<00:00, 2.18s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.40it/s]
          all          6          100          0.76          0.309
0.277      0.155
          microcrack          6          1          1          0
0          0
          porosity          6          8          0.682          0.75
0.624      0.395
          unmelted particle          6          91          0.597          0.176
0.207      0.0691

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  34/10000      7.83G        2.202        1.301        0.9586         59
640: 100% 4/4 [00:07<00:00, 1.81s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.53it/s]
          all          6          100          0.8          0.389
0.528      0.243
          microcrack          6          1          1          0
0.497      0.149
          porosity          6          8          0.725          0.75
0.653      0.465
          unmelted particle          6          91          0.675          0.418
0.435      0.115

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  35/10000      7.83G        2.375        1.316        1.031         62
640: 100% 4/4 [00:08<00:00, 2.16s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.69it/s]
          all          6          100          0.819          0.353
0.709      0.221
          microcrack          6          1          1          0
0.995      0.133

```


0.591	porosity	6	8	0.522	0.75
	0.344				
0.542	unmelted particle	6	91	0.934	0.309
	0.185				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
36/10000	7.83G	2.029	1.847	0.942	63
640: 100% 4/4	[00:08<00:00,	2.05s/it]			

Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	2.97it/s]
	all	6	100	0.791
				0.394

0.424	0.201				
	microcrack	6	1	1	0
0	0				

0.664	porosity	6	8	0.505	0.75
	0.415				
0.609	unmelted particle	6	91	0.867	0.432
	0.187				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
37/10000	7.83G	1.912	1.147	0.9333	62
640: 100% 4/4	[00:07<00:00,	1.82s/it]			

Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.31it/s]
	all	6	100	0.766
				0.269

0.369	0.145				
	microcrack	6	1	1	0
0.199	0.0236				

0.655	porosity	6	8	0.885	0.5
	0.351				
0.253	unmelted particle	6	91	0.412	0.308
	0.0606				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
38/10000	7.83G	2.419	1.799	0.9782	97
640: 100% 4/4	[00:08<00:00,	2.22s/it]			

Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.62it/s]
	all	6	100	0.772
				0.386

0.415	0.203				
	microcrack	6	1	1	0
0.0172	0.00172				

0.632	porosity	6	8	0.447	0.75
	0.407				
0.596	unmelted particle	6	91	0.87	0.407
	0.202				

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
39/10000		7.83G	1.952	1.302	0.9078	101
640: 100%	4/4	[00:08<00:00, 2.06s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 2.83it/s]			
		all	6	100	0.69	0.306
0.315	0.157					
	microcrack		6	1	1	0
0	0					
	porosity		6	8	0.627	0.631
0.655	0.383					
	unmelted particle		6	91	0.442	0.286
0.29	0.0881					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
40/10000		7.83G	2.265	1.448	0.9639	70
640: 100%	4/4	[00:07<00:00, 1.83s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.16it/s]			
		all	6	100	0.784	0.304
0.346	0.159					
	microcrack		6	1	1	0
0	0					
	porosity		6	8	0.484	0.625
0.535	0.316					
	unmelted particle		6	91	0.867	0.287
0.503	0.161					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
41/10000		7.83G	2.238	1.437	0.9741	56
640: 100%	4/4	[00:08<00:00, 2.20s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.57it/s]			
		all	6	100	0.833	0.337
0.393	0.178					
	microcrack		6	1	1	0
0	0					
	porosity		6	8	0.774	0.625
0.712	0.408					
	unmelted particle		6	91	0.726	0.385
0.468	0.127					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
42/10000		7.83G	2.036	1.092	0.957	58
640: 100%	4/4	[00:08<00:00, 2.05s/it]				
		Class	Images	Instances	Box(P	R

mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 3.11it/s]		
	all	6	100	0.37	0.544
0.515	0.242				
	microcrack	6	1	0.21	0.421
0.497	0.149				
	porosity	6	8	0.421	0.75
0.606	0.456				
	unmelted particle	6	91	0.478	0.462
0.44	0.12				

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
43/10000	7.83G	2.455	1.223	0.982	102
640: 100%	4/4	[00:07<00:00, 1.82s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.59it/s]		
	all	6	100	0.75	0.385
0.441	0.216				
	microcrack	6	1	1	0
0.249	0.0995				
	porosity	6	8	0.591	0.75
0.598	0.382				
	unmelted particle	6	91	0.66	0.405
0.476	0.167				

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
44/10000	7.83G	2.242	1.094	0.9446	66
640: 100%	4/4	[00:08<00:00, 2.14s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.47it/s]		
	all	6	100	0.705	0.292
0.323	0.133				
	microcrack	6	1	1	0
0.199	0.0199				
	porosity	6	8	0.554	0.625
0.498	0.305				
	unmelted particle	6	91	0.561	0.252
0.271	0.0748				

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
45/10000	7.83G	2.216	1.101	0.9403	98
640: 100%	4/4	[00:07<00:00, 1.93s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 3.19it/s]		
	all	6	100	0.491	0.755
0.671	0.276				
	microcrack	6	1	0.786	1
0.995	0.298				

0.538	porosity	6	8	0.307	0.75
	0.348				
0.48	unmelted particle	6	91	0.38	0.516
	0.18				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
46/10000	7.83G	2.439	1.171	0.9741	92
640: 100% 4/4	[00:07<00:00,	1.92s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.45it/s]	
	all	6	100	0.704	0.404
0.383	0.169				
	microcrack	6	1	1	0
0.0108	0.00324				
	porosity	6	8	0.651	0.702
0.611	0.331				
	unmelted particle	6	91	0.463	0.511
0.527	0.173				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
47/10000	7.83G	2.009	1.137	0.9363	68
640: 100% 4/4	[00:09<00:00,	2.26s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.68it/s]	
	all	6	100	0.567	0.75
0.732	0.243				
	microcrack	6	1	0.947	1
0.995	0.199				
	porosity	6	8	0.363	0.625
0.615	0.335				
	unmelted particle	6	91	0.392	0.626
0.584	0.194				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
48/10000	7.83G	2.201	1.277	0.907	140
640: 100% 4/4	[00:07<00:00,	1.86s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	3.24it/s]	
	all	6	100	0.588	0.676
0.669	0.234				
	microcrack	6	1	0.912	1
0.995	0.298				
	porosity	6	8	0.294	0.5
0.418	0.209				
	unmelted particle	6	91	0.559	0.527
0.595	0.194				

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
49/10000		7.83G	1.879	1.153	0.92	79
640: 100%	4/4	[00:07<00:00, 1.98s/it]				
mAP50	Class	Images	Instances	Box(P	R	
mAP50-95): 100%	1/1	[00:00<00:00, 4.60it/s]				
	all	6	100	0.773	0.35	
0.709	0.242					
	microcrack	6	1	1	0	
0.995	0.199					
	porosity	6	8	0.486	0.5	
0.497	0.309					
	unmelted particle	6	91	0.833	0.549	
0.635	0.219					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
50/10000		7.83G	2.138	1.189	0.9367	105
640: 100%	4/4	[00:08<00:00, 2.22s/it]				
mAP50	Class	Images	Instances	Box(P	R	
mAP50-95): 100%	1/1	[00:00<00:00, 4.66it/s]				
	all	6	100	0.633	0.289	
0.248	0.0843					
	microcrack	6	1	1	0	
0	0					
	porosity	6	8	0.355	0.5	
0.342	0.133					
	unmelted particle	6	91	0.544	0.368	
0.403	0.12					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
51/10000		7.83G	2.062	1.207	0.9402	99
640: 100%	4/4	[00:07<00:00, 1.77s/it]				
mAP50	Class	Images	Instances	Box(P	R	
mAP50-95): 100%	1/1	[00:00<00:00, 4.44it/s]				
	all	6	100	0.731	0.374	
0.674	0.238					
	microcrack	6	1	1	0	
0.995	0.256					
	porosity	6	8	0.413	0.617	
0.47	0.278					
	unmelted particle	6	91	0.779	0.504	
0.556	0.179					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
52/10000		7.83G	2.09	0.9636	0.9315	70
640: 100%	4/4	[00:08<00:00, 2.10s/it]				
	Class	Images	Instances	Box(P	R	

```

mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.63it/s]
          all          6          100          0.377          0.304
0.282      0.113
          microcrack          6          1          0          0
0          0
          porosity          6          8          0.434          0.625
0.446      0.212
          unmelted particle          6          91          0.697          0.286
0.4          0.127

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  53/10000      7.83G        2.116      1.054      0.9197         90
640: 100% 4/4 [00:08<00:00, 2.17s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.46it/s]
          all          6          100          0.678          0.342
0.302      0.141
          microcrack          6          1          1          0
0          0
          porosity          6          8          0.421          0.75
0.494      0.282
          unmelted particle          6          91          0.613          0.275
0.413      0.142

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  54/10000      7.83G        1.971      1.143      0.9977         35
640: 100% 4/4 [00:07<00:00, 1.81s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.55it/s]
          all          6          100          0.837          0.25
0.293      0.156
          microcrack          6          1          1          0
0          0
          porosity          6          8          0.713          0.621
0.549      0.329
          unmelted particle          6          91          0.797          0.13
0.331      0.139

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  55/10000      7.83G        2.148      1.091      0.937         144
640: 100% 4/4 [00:09<00:00, 2.26s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.53it/s]
          all          6          100          0.712          0.265
0.29      0.144
          microcrack          6          1          1          0
0          0

```

0.586	porosity	6	8	0.614	0.598
	0.34				
0.283	unmelted particle	6	91	0.522	0.198
	0.091				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
56/10000	7.83G	1.99	1.002	0.9339	100
640: 100% 4/4	[00:08<00:00,	2.18s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.52it/s]	
	all	6	100	0.675	0.377
0.415	0.226				
	microcrack	6	1	1	0
0.249	0.199				
	porosity	6	8	0.38	0.75
0.563	0.333				
	unmelted particle	6	91	0.646	0.38
0.434	0.147				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
57/10000	7.83G	2.124	0.9906	0.946	52
640: 100% 4/4	[00:07<00:00,	1.88s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.48it/s]	
	all	6	100	0.868	0.299
0.71	0.294				
	microcrack	6	1	1	0
0.995	0.298				
	porosity	6	8	0.742	0.5
0.582	0.361				
	unmelted particle	6	91	0.863	0.396
0.552	0.221				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
58/10000	7.83G	2.073	0.9515	0.9572	76
640: 100% 4/4	[00:09<00:00,	2.27s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.34it/s]	
	all	6	100	0.467	0.636
0.602	0.209				
	microcrack	6	1	0.719	1
0.995	0.199				
	porosity	6	8	0.428	0.625
0.577	0.35				
	unmelted particle	6	91	0.254	0.284
0.233	0.0774				

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
59/10000		7.83G	2.136	1.087	0.9628	60
640: 100%	4/4	[00:08<00:00, 2.14s/it]				
mAP50	Class	Images	Instances	Box(P	R	
mAP50-95): 100%	1/1	[00:00<00:00, 4.46it/s]				
	all	6	100	0.517	0.725	
0.705	0.376					
	microcrack	6	1	0.584	1	
0.995	0.497					
	porosity	6	8	0.428	0.625	
0.539	0.386					
	unmelted particle	6	91	0.538	0.549	
0.579	0.244					
Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
60/10000		7.83G	1.996	0.9151	0.9365	69
640: 100%	4/4	[00:07<00:00, 1.85s/it]				
mAP50	Class	Images	Instances	Box(P	R	
mAP50-95): 100%	1/1	[00:00<00:00, 4.56it/s]				
	all	6	100	0.649	0.255	
0.384	0.163					
	microcrack	6	1	1	0	
0.332	0.133					
	porosity	6	8	0.54	0.5	
0.507	0.258					
	unmelted particle	6	91	0.407	0.264	
0.312	0.0964					
Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
61/10000		7.83G	2.044	0.9931	0.918	81
640: 100%	4/4	[00:08<00:00, 2.19s/it]				
mAP50	Class	Images	Instances	Box(P	R	
mAP50-95): 100%	1/1	[00:00<00:00, 4.47it/s]				
	all	6	100	0.454	0.912	
0.751	0.392					
	microcrack	6	1	1	1	
0.995	0.497					
	porosity	6	8	0.0678	1	
0.605	0.407					
	unmelted particle	6	91	0.294	0.736	
0.655	0.273					
Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
62/10000		7.83G	2.027	0.9998	0.8943	128
640: 100%	4/4	[00:08<00:00, 2.19s/it]				
	Class	Images	Instances	Box(P	R	


```

mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.29it/s]
          all          6          100          0.609          0.315
0.469      0.143
          microcrack          6          1          1          0
0.497      0.0498
          porosity          6          8          0.403          0.625
0.539      0.254
          unmelted particle          6          91          0.425          0.319
0.371      0.125

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  63/10000      7.83G        2.104        1.128        0.9184         116
640: 100% 4/4 [00:07<00:00, 1.82s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.47it/s]
          all          6          100          0.827          0.374
0.781      0.342
          microcrack          6          1          1          0
0.995      0.321
          porosity          6          8          0.799          0.497
0.68      0.45
          unmelted particle          6          91          0.683          0.626
0.667      0.254

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  64/10000      7.83G        2.1         0.98        0.9371         136
640: 100% 4/4 [00:08<00:00, 2.18s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.32it/s]
          all          6          100          0.764          0.396
0.508      0.193
          microcrack          6          1          1          0
0.332      0.0663
          porosity          6          8          0.666          0.749
0.625      0.325
          unmelted particle          6          91          0.626          0.44
0.568      0.188

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  65/10000      7.83G        2.051        1.015        0.9215          73
640: 100% 4/4 [00:08<00:00, 2.24s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.38it/s]
          all          6          100          0.841          0.442
0.478      0.238
          microcrack          6          1          1          0
0.142      0.0284

```

0.717	porosity	6	8	0.838	0.75
	0.479				
0.575	unmelted particle	6	91	0.686	0.577
	0.206				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
66/10000	7.83G	1.841	0.9717	0.9804	64
640: 100% 4/4	[00:07<00:00,	1.82s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.47it/s]	
	all	6	100	0.83	0.412
0.605	0.219				
	microcrack	6	1	1	0
0.497	0.0995				
	porosity	6	8	0.847	0.699
0.709	0.357				
	unmelted particle	6	91	0.643	0.538
0.607	0.201				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
67/10000	7.83G	1.954	1.016	0.904	86
640: 100% 4/4	[00:08<00:00,	2.16s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.45it/s]	
	all	6	100	0.789	0.393
0.367	0.181				
	microcrack	6	1	1	0
0	0				
	porosity	6	8	0.845	0.75
0.692	0.405				
	unmelted particle	6	91	0.523	0.429
0.41	0.139				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
68/10000	7.83G	1.97	0.9313	0.9392	63
640: 100% 4/4	[00:08<00:00,	2.08s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	3.01it/s]	
	all	6	100	0.831	0.37
0.525	0.224				
	microcrack	6	1	1	0
0.332	0.0995				
	porosity	6	8	0.825	0.593
0.68	0.378				
	unmelted particle	6	91	0.667	0.516
0.562	0.195				

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
69/10000		7.83G	1.898	0.873	0.9063	125
640: 100%	4/4	[00:07<00:00, 1.91s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.58it/s]			
		all	6	100	0.766	0.306
0.441	0.194	microcrack	6	1	1	0
0.332	0.0663	porosity	6	8	0.823	0.587
0.627	0.407	unmelted particle	6	91	0.473	0.33
0.365	0.108					
Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
70/10000		7.83G	1.905	0.9229	0.9125	84
640: 100%	4/4	[00:08<00:00, 2.24s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.40it/s]			
		all	6	100	0.772	0.389
0.488	0.242	microcrack	6	1	1	0
0.332	0.0663	porosity	6	8	0.703	0.75
0.673	0.466	unmelted particle	6	91	0.612	0.418
0.458	0.193					
Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
71/10000		7.83G	1.9	0.892	0.9269	106
640: 100%	4/4	[00:08<00:00, 2.07s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 2.99it/s]			
		all	6	100	0.707	0.255
0.409	0.163	microcrack	6	1	1	0
0.332	0.0332	porosity	6	8	0.654	0.5
0.574	0.357	unmelted particle	6	91	0.467	0.264
0.321	0.0992					
Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
72/10000		7.83G	1.895	0.8608	0.898	97
640: 100%	4/4	[00:07<00:00, 1.93s/it]				
		Class	Images	Instances	Box(P	R

```

mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.33it/s]
          all          6          100          0.769          0.305
0.466      0.21
          microcrack          6          1          1          0
0.332      0.0663
          porosity          6          8          0.604          0.5
0.579      0.371
          unmelted particle          6          91          0.702          0.414
0.487      0.192

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  73/10000      7.83G      1.974      0.9309      0.9141          81
640: 100% 4/4 [00:08<00:00, 2.19s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.64it/s]
          all          6          100          0.899          0.269
0.467      0.197
          microcrack          6          1          1          0
0.332      0.0995
          porosity          6          8          1          0.489
0.628      0.343
          unmelted particle          6          91          0.697          0.319
0.443      0.148

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  74/10000      7.83G      1.841      0.9313      0.9234          81
640: 100% 4/4 [00:08<00:00, 2.11s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 2.92it/s]
          all          6          100          0.834          0.321
0.541      0.216
          microcrack          6          1          1          0
0.497      0.0498
          porosity          6          8          0.771          0.5
0.567      0.388
          unmelted particle          6          91          0.732          0.462
0.558      0.211

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  75/10000      7.83G      1.866      0.9023      0.9076          109
640: 100% 4/4 [00:07<00:00, 1.88s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.34it/s]
          all          6          100          0.804          0.406
0.424      0.218
          microcrack          6          1          1          0
0          0

```

0.715	porosity	6	8	0.844	0.68
	0.458				
0.557	unmelted particle	6	91	0.567	0.538
	0.197				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
76/10000	7.83G	1.816	0.9408	0.8752	62
640: 100%	4/4 [00:08<00:00, 2.24s/it]				
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1 [00:00<00:00, 4.56it/s]			
	all	6	100	0.818	0.41
0.626	0.278				
	microcrack	6	1	1	0
0.497	0.0995				
	porosity	6	8	0.795	0.625
0.727	0.46				
	unmelted particle	6	91	0.658	0.604
0.652	0.273				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
77/10000	7.83G	1.921	0.9401	0.9114	63
640: 100%	4/4 [00:08<00:00, 2.07s/it]				
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1 [00:00<00:00, 2.76it/s]			
	all	6	100	0.818	0.38
0.588	0.222				
	microcrack	6	1	1	0
0.497	0.0498				
	porosity	6	8	0.802	0.625
0.642	0.393				
	unmelted particle	6	91	0.653	0.516
0.624	0.224				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
78/10000	7.83G	1.817	0.9545	0.8969	46
640: 100%	4/4 [00:07<00:00, 1.87s/it]				
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1 [00:00<00:00, 4.32it/s]			
	all	6	100	0.896	0.437
0.66	0.297				
	microcrack	6	1	1	0
0.497	0.0995				
	porosity	6	8	0.955	0.75
0.804	0.535				
	unmelted particle	6	91	0.732	0.56
0.679	0.257				

	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size	79/10000	7.83G	1.849	0.9535	0.8945	86
640:	100% 4/4	[00:08<00:00, 2.23s/it]				
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.27it/s]			
	all	6	100	0.939	0.415	
0.486	0.252					
	microcrack	6	1	1	0	
0	0					
	porosity	6	8	0.937	0.75	
0.785	0.5					
	unmelted particle	6	91	0.879	0.495	
0.673	0.257					

	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size	80/10000	7.83G	1.859	0.9312	0.9194	82
640:	100% 4/4	[00:08<00:00, 2.17s/it]				
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 2.70it/s]			
	all	6	100	0.934	0.426	
0.511	0.277					
	microcrack	6	1	1	0	
0	0					
	porosity	6	8	1	0.727	
0.809	0.557					
	unmelted particle	6	91	0.802	0.549	
0.724	0.274					

	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size	81/10000	7.83G	1.982	0.926	0.9096	84
640:	100% 4/4	[00:07<00:00, 1.90s/it]				
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.34it/s]			
	all	6	100	0.487	0.796	
0.657	0.283					
	microcrack	6	1	0.441	1	
0.497	0.0498					
	porosity	6	8	0.38	0.75	
0.801	0.561					
	unmelted particle	6	91	0.64	0.637	
0.672	0.239					

	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size	82/10000	7.83G	1.936	0.8637	0.9404	96
640:	100% 4/4	[00:09<00:00, 2.29s/it]				
	Class	Images	Instances	Box(P	R	

```

mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.40it/s]
          all          6          100          0.619          0.774
0.838          0.339
          microcrack          6          1          0.491          1
0.995          0.144
          porosity          6          8          0.62          0.75
0.817          0.564
          unmelted particle          6          91          0.746          0.571
0.703          0.311

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
      83/10000      7.83G      1.844      0.8663      0.9159      148
640: 100% 4/4 [00:08<00:00, 2.11s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 2.92it/s]
          all          6          100          0.482          0.781
0.618          0.258
          microcrack          6          1          0.438          1
0.497          0.0498
          porosity          6          8          0.393          0.75
0.691          0.483
          unmelted particle          6          91          0.616          0.593
0.667          0.241

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
      84/10000      7.83G      1.909      0.9439      0.9101      123
640: 100% 4/4 [00:07<00:00, 1.93s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.50it/s]
          all          6          100          0.479          0.799
0.821          0.334
          microcrack          6          1          0.44          1
0.995          0.124
          porosity          6          8          0.397          0.75
0.785          0.581
          unmelted particle          6          91          0.6          0.648
0.684          0.297

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
      85/10000      7.83G      1.714      0.8654      0.9316      64
640: 100% 4/4 [00:08<00:00, 2.22s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.31it/s]
          all          6          100          0.781          0.415
0.442          0.208
          microcrack          6          1          1          0
0          0

```

0.643	porosity	6	8	0.56	0.75
	0.38				
0.682	unmelted particle	6	91	0.783	0.495
	0.245				

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
86/10000		7.83G	1.753	0.8668	0.921	72
640: 100%	4/4	[00:08<00:00,	2.08s/it]			
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	3.09it/s]		
	all	6	100	0.513	0.834	
0.837	0.339					
	microcrack	6	1	0.437	1	
0.995	0.199					
	porosity	6	8	0.447	0.81	
0.81	0.523					
	unmelted particle	6	91	0.654	0.692	
0.707	0.297					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
87/10000		7.83G	1.915	0.8823	0.8923	98
640: 100%	4/4	[00:07<00:00,	1.94s/it]			
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.15it/s]		
	all	6	100	0.769	0.372	
0.383	0.186					
	microcrack	6	1	1	0	
0	0					
	porosity	6	8	0.727	0.75	
0.695	0.408					
	unmelted particle	6	91	0.581	0.365	
0.455	0.149					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
88/10000		7.83G	1.925	0.8827	0.8755	119
640: 100%	4/4	[00:09<00:00,	2.29s/it]			
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.31it/s]		
	all	6	100	0.728	0.734	
0.775	0.319					
	microcrack	6	1	0.897	1	
0.995	0.217					
	porosity	6	8	0.532	0.75	
0.691	0.463					
	unmelted particle	6	91	0.755	0.451	
0.64	0.278					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
89/10000		7.83G	1.684	0.8534	0.904	99
640: 100%	4/4	[00:08<00:00, 2.20s/it]				
mAP50	Class	Images	Instances	Box(P	R	
mAP50-95): 100%	1/1	[00:00<00:00, 4.28it/s]				
	all	6	100	0.704	0.665	
0.687	0.233					
	microcrack	6	1	0.797	1	
0.995	0.199					
	porosity	6	8	0.698	0.625	
0.595	0.342					
	unmelted particle	6	91	0.616	0.37	
0.472	0.157					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
90/10000		7.83G	1.83	0.9238	0.8744	133
640: 100%	4/4	[00:07<00:00, 1.84s/it]				
mAP50	Class	Images	Instances	Box(P	R	
mAP50-95): 100%	1/1	[00:00<00:00, 4.27it/s]				
	all	6	100	0.808	0.659	
0.764	0.406					
	microcrack	6	1	0.888	1	
0.995	0.497					
	porosity	6	8	0.618	0.625	
0.674	0.458					
	unmelted particle	6	91	0.918	0.352	
0.624	0.264					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
91/10000		7.83G	1.925	0.8911	0.9233	91
640: 100%	4/4	[00:09<00:00, 2.26s/it]				
mAP50	Class	Images	Instances	Box(P	R	
mAP50-95): 100%	1/1	[00:00<00:00, 4.14it/s]				
	all	6	100	0.716	0.637	
0.723	0.266					
	microcrack	6	1	0.79	1	
0.995	0.224					
	porosity	6	8	0.649	0.625	
0.715	0.423					
	unmelted particle	6	91	0.709	0.286	
0.458	0.15					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
92/10000		7.83G	1.8	0.8433	0.8818	84
640: 100%	4/4	[00:08<00:00, 2.22s/it]				
	Class	Images	Instances	Box(P	R	

```

mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.33it/s]
          all          6          100          0.694          0.765
0.787          0.395
          microcrack          6          1          0.783          1
0.995          0.398
          porosity          6          8          0.564          0.813
0.724          0.518
          unmelted particle          6          91          0.735          0.484
0.643          0.268

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  93/10000      7.83G      1.813      0.9183      0.9186          62
640: 100% 4/4 [00:07<00:00, 1.84s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.64it/s]
          all          6          100          0.914          0.224
0.339          0.169
          microcrack          6          1          1          0
0          0
          porosity          6          8          0.904          0.5
0.644          0.378
          unmelted particle          6          91          0.839          0.172
0.374          0.128

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  94/10000      7.83G      1.836      0.9155      0.9296          48
640: 100% 4/4 [00:08<00:00, 2.24s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.36it/s]
          all          6          100          0.672          0.712
0.773          0.38
          microcrack          6          1          0.757          1
0.995          0.398
          porosity          6          8          0.464          0.75
0.751          0.494
          unmelted particle          6          91          0.796          0.386
0.573          0.247

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  95/10000      7.83G      1.862      0.9195      0.8784          133
640: 100% 4/4 [00:08<00:00, 2.16s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.48it/s]
          all          6          100          0.39          0.622
0.433          0.192
          microcrack          6          1          0.265          0.796
0.332          0.0995

```

	porosity	6	8	0.464	0.75	
0.621	0.372					
	unmelted particle	6	91	0.441	0.32	
0.347	0.105					
	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size	96/10000	7.83G	2.059	0.9587	0.8815	181
640:	100% 4/4 [00:07<00:00,	1.82s/it]				
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100% 1/1 [00:00<00:00,	4.48it/s]				
	all	6	100	0.797	0.742	
0.784	0.459					
	microcrack	6	1	0.86	1	
0.995	0.597					
	porosity	6	8	0.615	0.75	
0.708	0.507					
	unmelted particle	6	91	0.916	0.476	
0.649	0.273					
	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size	97/10000	7.83G	1.976	0.8915	0.8649	73
640:	100% 4/4 [00:08<00:00,	2.22s/it]				
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100% 1/1 [00:00<00:00,	4.61it/s]				
	all	6	100	0.377	0.495	
0.449	0.213					
	microcrack	6	1	0	0	
0.00765	0.000765					
	porosity	6	8	0.485	0.827	
0.675	0.413					
	unmelted particle	6	91	0.645	0.659	
0.666	0.226					
	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size	98/10000	7.83G	1.837	0.8652	0.8927	58
640:	100% 4/4 [00:08<00:00,	2.12s/it]				
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100% 1/1 [00:00<00:00,	3.03it/s]				
	all	6	100	0.64	0.848	
0.783	0.389					
	microcrack	6	1	0.973	1	
0.995	0.398					
	porosity	6	8	0.386	0.875	
0.704	0.503					
	unmelted particle	6	91	0.561	0.67	
0.65	0.266					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
99/10000		7.83G	1.833	0.7918	0.8764	69
640: 100%	4/4	[00:07<00:00, 1.86s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.21it/s]			
		all	6	100	0.745	0.411
0.439	0.226					
	microcrack		6	1	1	0
0	0					
	porosity		6	8	0.489	0.75
0.661	0.433					
	unmelted particle		6	91	0.746	0.484
0.656	0.246					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
100/10000		7.83G	1.833	0.87	0.9163	53
640: 100%	4/4	[00:08<00:00, 2.16s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.43it/s]			
		all	6	100	0.787	0.448
0.645	0.344					
	microcrack		6	1	1	0
0.497	0.249					
	porosity		6	8	0.534	0.75
0.736	0.495					
	unmelted particle		6	91	0.827	0.593
0.7	0.287					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
101/10000		7.83G	1.795	0.8796	0.8589	34
640: 100%	4/4	[00:08<00:00, 2.08s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 2.94it/s]			
		all	6	100	0.628	0.459
0.747	0.256					
	microcrack		6	1	1	0
0.995	0.11					
	porosity		6	8	0.323	0.75
0.66	0.435					
	unmelted particle		6	91	0.562	0.626
0.587	0.222					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
102/10000		7.83G	1.848	0.8922	0.9079	72
640: 100%	4/4	[00:07<00:00, 1.79s/it]				
		Class	Images	Instances	Box(P	R

```

mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.16it/s]
          all          6          100          0.479          0.821
0.829          0.476
          microcrack          6          1          0.501          1
0.995          0.597
          porosity          6          8          0.338          0.75
0.787          0.515
          unmelted particle          6          91          0.598          0.714
0.705          0.316

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  103/10000        7.83G        1.793      0.8304      0.8697          99
640: 100% 4/4 [00:08<00:00, 2.14s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.54it/s]
          all          6          100          0.419          0.382
0.457          0.208
          microcrack          6          1          0          0
0.166          0.0498
          porosity          6          8          0.545          0.749
0.668          0.388
          unmelted particle          6          91          0.712          0.396
0.538          0.188

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  104/10000        7.83G        1.736      0.8681      0.8883          65
640: 100% 4/4 [00:07<00:00, 1.94s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 2.96it/s]
          all          6          100          0.747          0.708
0.822          0.29
          microcrack          6          1          0.481          1
0.995          0.107
          porosity          6          8          0.815          0.75
0.782          0.479
          unmelted particle          6          91          0.944          0.373
0.69          0.284

```

```

          Epoch      GPU_mem    box_loss    cls_loss    dfl_loss  Instances
Size
  105/10000        7.83G        1.9      0.8721      0.8795          99
640: 100% 4/4 [00:07<00:00, 1.95s/it]
          Class      Images  Instances      Box(P          R
mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.29it/s]
          all          6          100          0.792          0.591
0.74          0.231
          microcrack          6          1          0.849          1
0.995          0.0995

```

0.668	porosity	6	8	0.564	0.5
	0.392				
0.558	unmelted particle	6	91	0.961	0.274
	0.201				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
106/10000	7.83G	1.658	0.8485	0.863	71
640: 100% 4/4	[00:08<00:00, 2.20s/it]				
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.41it/s]		
	all	6	100	0.779	0.649
0.802	0.345				
	microcrack	6	1	0.818	1
0.995	0.298				
	porosity	6	8	0.683	0.5
0.72	0.423				
	unmelted particle	6	91	0.836	0.448
0.69	0.312				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
107/10000	7.83G	1.781	0.8707	0.8654	158
640: 100% 4/4	[00:08<00:00, 2.01s/it]				
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 2.99it/s]		
	all	6	100	0.723	0.68
0.8	0.299				
	microcrack	6	1	0.588	1
0.995	0.199				
	porosity	6	8	0.738	0.625
0.769	0.452				
	unmelted particle	6	91	0.843	0.414
0.635	0.245				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
108/10000	7.83G	1.748	0.8551	0.8795	85
640: 100% 4/4	[00:07<00:00, 1.91s/it]				
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 3.97it/s]		
	all	6	100	0.708	0.763
0.787	0.384				
	microcrack	6	1	0.867	1
0.995	0.398				
	porosity	6	8	0.612	0.75
0.726	0.47				
	unmelted particle	6	91	0.644	0.538
0.64	0.284				

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
109/10000		7.83G	1.811	0.8506	0.8618	50
640: 100%	4/4	[00:09<00:00, 2.26s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.44it/s]			
		all	6	100	0.767	0.693
0.784	0.298	microcrack	6	1	0.909	1
0.995	0.149	porosity	6	8	0.555	0.625
0.721	0.491	unmelted particle	6	91	0.838	0.453
0.635	0.254					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
110/10000		7.83G	1.777	0.8218	0.8744	47
640: 100%	4/4	[00:07<00:00, 1.86s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 2.95it/s]			
		all	6	100	0.752	0.717
0.772	0.337	microcrack	6	1	0.8	1
0.995	0.365	porosity	6	8	0.614	0.625
0.613	0.35	unmelted particle	6	91	0.842	0.526
0.708	0.295					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
111/10000		7.83G	1.767	0.8249	0.88	80
640: 100%	4/4	[00:08<00:00, 2.03s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.42it/s]			
		all	6	100	0.502	0.815
0.829	0.429	microcrack	6	1	0.44	1
0.995	0.398	porosity	6	8	0.408	0.75
0.784	0.592	unmelted particle	6	91	0.657	0.696
0.709	0.296					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
112/10000		7.83G	1.821	0.8198	0.8777	97
640: 100%	4/4	[00:09<00:00, 2.29s/it]				
		Class	Images	Instances	Box(P	R

mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.24it/s]		
	all	6	100	0.58	0.807
0.816	0.366				
	microcrack	6	1	0.73	1
0.995	0.309				
	porosity	6	8	0.367	0.75
0.726	0.489				
	unmelted particle	6	91	0.644	0.67
0.725	0.301				

	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size						
113/10000	7.83G	1.673	0.8343	0.8699	63	
640: 100%	4/4	[00:08<00:00, 2.18s/it]				
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 2.64it/s]			
	all	6	100	0.648	0.801	
0.769	0.311					
	microcrack	6	1	0.968	1	
0.995	0.199					
	porosity	6	8	0.373	0.75	
0.677	0.479					
	unmelted particle	6	91	0.604	0.653	
0.633	0.257					

	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size						
114/10000	7.83G	1.716	0.7739	0.8821	114	
640: 100%	4/4	[00:07<00:00, 1.92s/it]				
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.10it/s]			
	all	6	100	0.576	0.77	
0.76	0.365					
	microcrack	6	1	0.793	1	
0.995	0.398					
	porosity	6	8	0.337	0.75	
0.698	0.469					
	unmelted particle	6	91	0.599	0.56	
0.589	0.227					

	Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size						
115/10000	7.83G	1.744	0.8346	0.8769	82	
640: 100%	4/4	[00:09<00:00, 2.35s/it]				
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.25it/s]			
	all	6	100	0.508	0.781	
0.778	0.365					
	microcrack	6	1	0.572	1	
0.995	0.365					

0.735	porosity	6	8	0.376	0.75
0.493					
0.606	unmelted particle	6	91	0.575	0.593
0.236					

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
116/10000	7.83G	1.702	0.8521	0.9023	49
640: 100% 4/4	[00:08<00:00,	2.10s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	2.82it/s]	
	all	6	100	0.893	0.334
0.445	0.238				
0	microcrack	6	1	1	0
0.695	porosity	6	8	0.759	0.625
0.476					
0.64	unmelted particle	6	91	0.92	0.378
0.238					

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
117/10000	7.83G	1.74	0.8584	0.8918	128
640: 100% 4/4	[00:07<00:00,	1.86s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.30it/s]	
	all	6	100	0.92	0.404
0.64	0.255				
0.497	microcrack	6	1	1	0
0.78	porosity	6	8	0.853	0.729
0.483					
0.642	unmelted particle	6	91	0.906	0.484
0.233					

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
118/10000	7.83G	1.825	0.8769	0.8882	125
640: 100% 4/4	[00:09<00:00,	2.30s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.02it/s]	
	all	6	100	0.473	0.333
0.42	0.24				
0	microcrack	6	1	0	0
0.736	porosity	6	8	0.669	0.625
0.496					
0.523	unmelted particle	6	91	0.75	0.374
0.224					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
119/10000		7.83G	1.723	0.8636	0.8987	74
640: 100%	4/4	[00:08<00:00, 2.01s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 3.01it/s]			
		all	6	100	0.614	0.804
0.83	0.347					
	microcrack		6	1	0.761	1
0.995	0.199					
	porosity		6	8	0.501	0.75
0.819	0.582					
	unmelted particle		6	91	0.578	0.662
0.677	0.26					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
120/10000		7.83G	1.659	0.79	0.8829	54
640: 100%	4/4	[00:07<00:00, 1.79s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.52it/s]			
		all	6	100	0.601	0.748
0.759	0.321					
	microcrack		6	1	0.77	1
0.995	0.398					
	porosity		6	8	0.382	0.75
0.676	0.351					
	unmelted particle		6	91	0.65	0.495
0.606	0.213					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
121/10000		7.83G	1.729	0.8476	0.8926	131
640: 100%	4/4	[00:08<00:00, 2.17s/it]				
		Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.36it/s]			
		all	6	100	0.545	0.86
0.755	0.311					
	microcrack		6	1	0.722	1
0.995	0.298					
	porosity		6	8	0.356	0.875
0.622	0.363					
	unmelted particle		6	91	0.557	0.706
0.648	0.272					

Size	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
122/10000		7.83G	1.671	0.8514	0.9005	61
640: 100%	4/4	[00:08<00:00, 2.04s/it]				
		Class	Images	Instances	Box(P	R

mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	2.96it/s]		
	all	6	100	0.673	0.503	
0.77	0.323					
	microcrack	6	1	1	0	
0.995	0.398					
	porosity	6	8	0.459	0.849	
0.687	0.325					
	unmelted particle	6	91	0.561	0.659	
0.628	0.246					

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
123/10000	7.83G	1.578	0.8525	0.8664	50
640: 100%	4/4	[00:07<00:00,	1.87s/it]		
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.48it/s]	
	all	6	100	0.479	0.832
0.782	0.38				
	microcrack	6	1	0.492	1
0.995	0.398				
	porosity	6	8	0.341	0.778
0.642	0.414				
	unmelted particle	6	91	0.603	0.719
0.71	0.326				

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
124/10000	7.83G	1.74	0.8408	0.8833	86
640: 100%	4/4	[00:08<00:00,	2.15s/it]		
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.44it/s]	
	all	6	100	0.705	0.722
0.712	0.28				
	microcrack	6	1	0.899	1
0.995	0.298				
	porosity	6	8	0.537	0.75
0.545	0.327				
	unmelted particle	6	91	0.677	0.415
0.595	0.214				

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
125/10000	7.83G	1.717	0.8216	0.8854	66
640: 100%	4/4	[00:08<00:00,	2.07s/it]		
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	3.17it/s]	
	all	6	100	0.759	0.763
0.772	0.371				
	microcrack	6	1	0.904	1
0.995	0.398				

0.639	porosity	6	8	0.533	0.75
	0.428				
0.684	unmelted particle	6	91	0.841	0.538
	0.287				

	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size	126/10000	7.83G	1.882	0.8147	0.8692	114
640: 100%	4/4	[00:07<00:00,	1.88s/it]			
	Class	Images	Instances	Box(P		R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.38it/s]		
	all	6	100	0.766		0.699
0.761	0.421					
	microcrack	6	1	0.89		1
0.995	0.697					
	porosity	6	8	0.575		0.625
0.573	0.32					
	unmelted particle	6	91	0.834		0.473
0.715	0.245					

	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size	127/10000	7.83G	1.749	0.8349	0.8641	56
640: 100%	4/4	[00:09<00:00,	2.31s/it]			
	Class	Images	Instances	Box(P		R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.24it/s]		
	all	6	100	0.751		0.675
0.771	0.362					
	microcrack	6	1	0.896		1
0.995	0.398					
	porosity	6	8	0.484		0.5
0.585	0.403					
	unmelted particle	6	91	0.872		0.524
0.733	0.285					

	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size	128/10000	7.83G	1.686	0.8416	0.8622	51
640: 100%	4/4	[00:08<00:00,	2.01s/it]			
	Class	Images	Instances	Box(P		R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	2.96it/s]		
	all	6	100	0.64		0.632
0.717	0.315					
	microcrack	6	1	0.521		1
0.995	0.398					
	porosity	6	8	0.612		0.5
0.569	0.333					
	unmelted particle	6	91	0.787		0.396
0.586	0.214					

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
129/10000	7.83G	1.809	0.8866	0.8799	79
640: 100% 4/4	[00:07<00:00, 1.97s/it]				
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.22it/s]		
	all	6	100	0.588	0.632
0.532	0.259				
	microcrack	6	1	0.279	1
0.332	0.119				
	porosity	6	8	0.57	0.5
0.547	0.344				
	unmelted particle	6	91	0.913	0.396
0.717	0.312				
Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
130/10000	7.83G	1.712	0.8027	0.8454	140
640: 100% 4/4	[00:08<00:00, 2.24s/it]				
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.19it/s]		
	all	6	100	0.63	0.572
0.533	0.211				
	microcrack	6	1	0.312	1
0.497	0.166				
	porosity	6	8	0.736	0.354
0.48	0.274				
	unmelted particle	6	91	0.841	0.363
0.621	0.195				
Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
131/10000	7.83G	1.78	0.8609	0.8611	109
640: 100% 4/4	[00:07<00:00, 1.94s/it]				
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 2.60it/s]		
	all	6	100	0.775	0.717
0.756	0.429				
	microcrack	6	1	0.883	1
0.995	0.597				
	porosity	6	8	0.555	0.625
0.561	0.378				
	unmelted particle	6	91	0.889	0.526
0.711	0.312				
Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
132/10000	7.83G	1.756	0.8074	0.891	73
640: 100% 4/4	[00:07<00:00, 1.96s/it]				
	Class	Images	Instances	Box(P	R

mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.29it/s]		
	all	6	100	0.708	0.692
0.721	0.275				
	microcrack	6	1	0.884	1
0.995	0.303				
	porosity	6	8	0.512	0.625
0.579	0.324				
	unmelted particle	6	91	0.729	0.451
0.589	0.199				

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
133/10000	7.83G	1.933	0.8864	0.8674	153
640: 100%	4/4	[00:09<00:00, 2.27s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.25it/s]		
	all	6	100	0.668	0.717
0.772	0.413				
	microcrack	6	1	0.848	1
0.995	0.497				
	porosity	6	8	0.406	0.625
0.631	0.426				
	unmelted particle	6	91	0.752	0.527
0.689	0.314				

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
134/10000	7.83G	1.657	0.7835	0.8745	69
640: 100%	4/4	[00:08<00:00, 2.07s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 3.00it/s]		
	all	6	100	0.615	0.654
0.758	0.318				
	microcrack	6	1	0.333	1
0.995	0.298				
	porosity	6	8	0.511	0.625
0.616	0.403				
	unmelted particle	6	91	1	0.338
0.664	0.252				

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
135/10000	7.83G	1.696	0.8378	0.8774	52
640: 100%	4/4	[00:07<00:00, 1.97s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.32it/s]		
	all	6	100	0.687	0.424
0.776	0.413				
	microcrack	6	1	1	0
0.995	0.497				

0.62	porosity	6	8	0.39	0.625
0.433					
0.711	unmelted particle	6	91	0.67	0.648
0.309					

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
136/10000	7.83G	1.671	0.7662	0.8677	106
640: 100% 4/4	[00:09<00:00,	2.25s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.52it/s]	
	all	6	100	0.48	0.654
0.526	0.239				
	microcrack	6	1	0.281	0.842
0.332	0.0995				
	porosity	6	8	0.411	0.625
0.599	0.385				
	unmelted particle	6	91	0.748	0.495
0.647	0.233				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
137/10000	7.83G	1.562	0.7132	0.8699	74
640: 100% 4/4	[00:07<00:00,	1.90s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	3.05it/s]	
	all	6	100	0.663	0.739
0.788	0.397				
	microcrack	6	1	0.82	1
0.995	0.398				
	porosity	6	8	0.459	0.625
0.711	0.5				
	unmelted particle	6	91	0.711	0.593
0.656	0.291				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
138/10000	7.83G	1.678	0.7819	0.8844	45
640: 100% 4/4	[00:07<00:00,	1.96s/it]			
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.32it/s]	
	all	6	100	0.659	0.707
0.768	0.36				
	microcrack	6	1	0.902	1
0.995	0.298				
	porosity	6	8	0.471	0.625
0.693	0.516				
	unmelted particle	6	91	0.604	0.495
0.616	0.265				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
139/10000	7.83G	1.676	0.788	0.8746	106
640: 100% 4/4	[00:08<00:00, 2.17s/it]				
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.40it/s]		
	all	6	100	0.688	0.741
0.813	0.372				
	microcrack	6	1	0.984	1
0.995	0.298				
	porosity	6	8	0.461	0.642
0.799	0.543				
	unmelted particle	6	91	0.619	0.582
0.645	0.275				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
140/10000	7.83G	1.811	0.8425	0.8836	100
640: 100% 4/4	[00:07<00:00, 1.84s/it]				
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 3.00it/s]		
	all	6	100	0.687	0.407
0.797	0.376				
	microcrack	6	1	1	0
0.995	0.398				
	porosity	6	8	0.421	0.637
0.751	0.457				
	unmelted particle	6	91	0.64	0.582
0.644	0.273				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
141/10000	7.83G	1.635	0.7744	0.8757	88
640: 100% 4/4	[00:07<00:00, 1.94s/it]				
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.58it/s]		
	all	6	100	0.449	0.728
0.767	0.329				
	microcrack	6	1	0.382	1
0.995	0.298				
	porosity	6	8	0.365	0.625
0.667	0.398				
	unmelted particle	6	91	0.601	0.56
0.639	0.29				

Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size					
142/10000	7.83G	1.75	0.8046	0.8725	78
640: 100% 4/4	[00:08<00:00, 2.17s/it]				
	Class	Images	Instances	Box(P	R

mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.33it/s]		
	all	6	100	0.696	0.439	
0.531	0.256					
	microcrack	6	1	1	0	
0.249	0.0498					
	porosity	6	8	0.394	0.625	
0.618	0.404					
	unmelted particle	6	91	0.694	0.692	
0.725	0.314					

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
143/10000	7.83G	1.741	0.7503	0.8647	61
640: 100%	4/4	[00:07<00:00,	1.78s/it]		
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.54it/s]	
	all	6	100	0.777	0.339
0.438	0.196				
	microcrack	6	1	1	0
0.0622	0.0152				
	porosity	6	8	0.679	0.5
0.616	0.299				
	unmelted particle	6	91	0.653	0.516
0.635	0.273				

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
144/10000	7.83G	1.677	0.7966	0.8655	77
640: 100%	4/4	[00:08<00:00,	2.22s/it]		
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.31it/s]	
	all	6	100	0.559	0.673
0.74	0.312				
	microcrack	6	1	0.328	1
0.995	0.348				
	porosity	6	8	0.664	0.375
0.535	0.301				
	unmelted particle	6	91	0.685	0.645
0.69	0.286				

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances
Size					
145/10000	7.83G	1.574	0.7948	0.8696	47
640: 100%	4/4	[00:09<00:00,	2.28s/it]		
	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.41it/s]	
	all	6	100	0.673	0.636
0.711	0.242				
	microcrack	6	1	0.813	1
0.995	0.199				

0.464	porosity	6	8	0.571	0.339
	0.236				
	unmelted particle	6	91	0.633	0.569
0.675	0.29				

	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size						
	146/10000	7.83G	1.7	0.7547	0.8892	77
640:	100% 4/4	[00:07<00:00,	1.78s/it]			
	Class	Images	Instances	Box(P		R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.25it/s]		
	all	6	100	0.555		0.684
0.725	0.284					
	microcrack	6	1	0.69		1
0.995	0.298					
	porosity	6	8	0.409		0.436
0.545	0.301					
	unmelted particle	6	91	0.567		0.615
0.635	0.254					

	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size						
	147/10000	7.83G	1.581	0.7379	0.8728	59
640:	100% 4/4	[00:08<00:00,	2.22s/it]			
	Class	Images	Instances	Box(P		R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.69it/s]		
	all	6	100	0.56		0.649
0.723	0.253					
	microcrack	6	1	0.501		1
0.995	0.228					
	porosity	6	8	0.538		0.298
0.489	0.248					
	unmelted particle	6	91	0.639		0.648
0.684	0.285					

	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size						
	148/10000	7.83G	1.642	0.7868	0.8792	44
640:	100% 4/4	[00:08<00:00,	2.16s/it]			
	Class	Images	Instances	Box(P		R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00,	4.43it/s]		
	all	6	100	0.658		0.59
0.696	0.27					
	microcrack	6	1	0.843		1
0.995	0.298					
	porosity	6	8	0.458		0.25
0.463	0.257					
	unmelted particle	6	91	0.673		0.52
0.629	0.255					

	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size	149/10000	7.83G	1.583	0.7848	0.8766	60
640:	100% 4/4	[00:07<00:00, 1.85s/it]				
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.59it/s]			
	all	6	100	0.718	0.615	
0.755	0.231					
	microcrack	6	1	0.86	1	
0.995	0.0995					
	porosity	6	8	0.536	0.295	
0.603	0.309					
	unmelted particle	6	91	0.758	0.551	
0.666	0.285					

	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size	150/10000	7.83G	1.758	0.7899	0.8772	39
640:	100% 4/4	[00:08<00:00, 2.17s/it]				
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.44it/s]			
	all	6	100	0.664	0.685	
0.749	0.294					
	microcrack	6	1	0.821	1	
0.995	0.298					
	porosity	6	8	0.42	0.375	
0.536	0.294					
	unmelted particle	6	91	0.751	0.681	
0.716	0.291					

	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size	151/10000	7.83G	1.666	0.7685	0.8516	75
640:	100% 4/4	[00:08<00:00, 2.09s/it]				
	Class	Images	Instances	Box(P	R	
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 2.73it/s]			
	all	6	100	0.426	0.406	
0.447	0.224					
	microcrack	6	1	0	0	
0	0					
	porosity	6	8	0.606	0.581	
0.638	0.384					
	unmelted particle	6	91	0.671	0.637	
0.704	0.288					

	Epoch	GPU_mem	box_loss	cls_loss	df_l_loss	Instances
Size	152/10000	7.83G	1.646	0.7371	0.874	63
640:	100% 4/4	[00:07<00:00, 1.91s/it]				
	Class	Images	Instances	Box(P	R	

```

mAP50  mAP50-95): 100% 1/1 [00:00<00:00, 4.31it/s]
              all          6          100          0.793          0.769
0.805      0.314
              microcrack          6          1          0.84          1
0.995      0.199
              porosity          6          8          0.822          0.625
0.692      0.429
              unmelted particle          6          91          0.717          0.681
0.729      0.314
Stopping training early as no improvement observed in last 50 epochs.
Best results observed at epoch 102, best model saved as best.pt.
To update EarlyStopping(patience=50) pass a new patience value, i.e.
`patience=300` or use `patience=0` to disable EarlyStopping.

```

```

152 epochs completed in 0.387 hours.
Optimizer stripped from runs/detect/train/weights/last.pt, 22.5MB
Optimizer stripped from runs/detect/train/weights/best.pt, 22.5MB

```

```

Validating runs/detect/train/weights/best.pt...
Ultralytics YOLOv8.0.20 🚀 Python-3.10.6 torch-2.0.1+cu118 CUDA:0
(Tesla V100-SXM2-16GB, 16151MiB)
Model summary (fused): 168 layers, 11126745 parameters, 0 gradients,
28.4 GFLOPs

```

	Class	Images	Instances	Box(P	R
mAP50	mAP50-95): 100%	1/1	[00:00<00:00, 4.68it/s]		
	all	6	100	0.479	0.821
0.823	0.474				
	microcrack	6	1	0.501	1
0.995	0.597				
	porosity	6	8	0.337	0.75
0.768	0.508				
	unmelted particle	6	91	0.598	0.714
0.705	0.316				

```

Speed: 0.2ms pre-process, 2.3ms inference, 0.0ms loss, 1.1ms post-
process per image
Results saved to runs/detect/train

```

```
!ls
```

```

data.yaml      README roboflow.txt  test  yolov8s.pt
README.dataset.txt  runs      train

```

```
model = YOLO('/content/yolov8-1/runs/detect/train/weights/best.pt')
```

```

from ultralytics import YOLO
from PIL import Image
import cv2

```

```
# from PIL
```

```

img =
Image.open("/content/yolov8-1/test/images/rsz_slm_square_finalx15k_003

```

```
5_jpg.rf.e5c332015d1f1a4bd24149f60d603f7c.jpg")
results = model.predict(source=img, save=True)

Ultralytics YOLOv8.0.20 🚀 Python-3.10.6 torch-2.0.1+cu118 CUDA:0
(Tesla V100-SXM2-16GB, 16151MiB)
Model summary (fused): 168 layers, 11126745 parameters, 0 gradients,
28.4 GFLOPs
Results saved to runs/detect/predict

# print(results)
display(Image.open('/content/yolov8-1/runs/detect/predict/image0.jpg'))
```

porosity 0.71

unmelted particle

unmelted particle 0.29

unmelted particle

unmelted particle 0.33

unmelted particle 0.67

unmelted particle 0.68

unmelted po

unmelted particle 0.84

unmelted particle 0.69

unmelted particle 0.83

15kV 7.0mm L-X1.50k BSE H

100μm