

- Material: Aluminium (Chaolin) A7075 aluminium with $\Phi 1.2\text{mm}$
- Stand-off distance: **10 mm**
- Laser spot size (diameter): **1.2 mm**
- Experiment date: 19-02-2024
- Sensors: Xiris Microphone, Xiris thermal camera, data recorded by Xiris WeldStudio Pro software.
- Helper: Jonathan

Experiment number	Geometry	Dwell time (s)	Laser power (kW)	Speed (mm/min)	Wire feeding rate (m/min)	Layer height (mm)	Step Over/Hatch Space (mm)	Remarks
#1 (trial)	Block (40x30 mm), 1 layer	N.A.	2.1	1500	3	N.A	1.7	Reduce 50% compress air (2 bar)
#2 (trial)	Block (40x30 mm), 1 layer	N.A.	2.1	1500	3	N.A	1.7	Reduce further compress air (1 bar); Previous one focus is not good. Now put closer. Now it is too close
#3 (trial)	Block (40x30 mm), 1 layer	N.A.	2.1	1500	3	N.A	1.7	The distance must be 30. Now adjusted. Angle not good. The microphone put closer now better.
#4	Block (40x30 mm), 1 layer	N.A.	2.1	1500	3	N.A	1.7	Further adjustment to camera position
#5	Block (40x30 mm), 1 layer	N.A.	2.1	1500	3	N.A	1.7	Finalized camera position (but WAAM is going on), one defects

#6	Block (40x30 mm), 1 layer	N.A.	2.1	1500	3	N.A.	1.7	Good experiment (conduction mode)
#7	Block (30 x 40 mm), 1 layer	N.A.	2.5	1500	3	N.A.	1.7	Printed on top of #6 i.e., second layer
#8	Block (30 x 40 mm), 2 layer. 2 nd layer did not finish	Dwell time need to see from video, around 30s	2.9	1500	3	N.A.	1.7	A new print, a balling defect showed immediately after second layer starts (keyhole regime)
#9	Block (30 x 40 mm), 2 layer	N.A.	2.3	2100	3	N.A.	1.7	A new print (conduction mode), one problem in the second layer with lack of fusion
#10	Block (30 x 40 mm), 2 layer	N.A.	1.5	2100	3	N.A.	1.7	A new print (LoF mode)
#11	Block (single bead wall), 30 layers	N.A.	2.1	2100	3	1.4	1.7	Conduction mode Wrong setting
#12	Block (single bead wall), 30 layers	N.A.	2.1	2100	3	1.4	1.7	Conduction mode Wrong setting (only first layer is usable.)
#13	Block (single bead wall), 30 layers	N.A.	2.1	2100	3	1.4	1.7	Conduction mode See the transitions

#14	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	Ambient (Air pressure 3 bar + WAAM noise)
#15	First layer, 75 x 70	N.A.	2.1	1500	3	1.4	1.7	Chaolin Printing, changed to his Al wire. Good condition, noise of WAAM exists
#16	Third layer, 75 x 70	N.A.	2.1	1500	3	1.4	1.7	Chaolin Printing, changed to his Al wire. Good condition, WAAM exists

22 Feb 2024, Thursday, follow-up experiments.

Experiment number	Geometry	Dwell time (s)	Laser power (kW)	Speed (mm/min)	Wire feeding rate (m/min)	Layer height (mm)	Step Over/Hatch Space (mm)	Remarks
#17	40 x 40. Block 2 layers	N.A.	1.8	2100	3	1.4	1.7	Should be LoF mode, a lot of balling defects→ Machine fault (wire feeder loose, makes it inconsistent)
#18	40 x 40 Block 2 layers	N.A.	1	2100	3	1.4	1.7	Should be LoF mode, a lot of balling→ Machine fault (wire feeder loose, makes it inconsistent)
#19	40 x 40 Block, 2 layers	N.A.	2.1	900	3	1.4	1.7	Should be conduction mode, significant balling defects. Some error occurred of wire setting. → Machine fault (wire feeder loose, makes it inconsistent)

#20	40 x 40 Block, 2 layers	N.A.	2.1	900	3	1.4	1.7	Should be conduction mode. Finally working. But Xing Wei WAMM is ongoing
#21	40 x 40 Block, 2 layers	N.A.	2.1	900	3	1.4	1.7	Now everything perfect. A perfect example of weak conduction mode
#22	40 x 40. Block 2 layers	N.A.	1.8	2100	3	1.4	1.7	LoF. WAAM process showed up in the middle. Shut down afterwards.
#23	40 x 30. Block 2 layers	N.A.	2.9	900	3	1.4	1.7	Keyhole, maybe. But seems quite ok.
#24	40 x 30. Block 2 layers	N.A.	2.9	480	3	1.4	1.7	Keyhole, maybe. But seems quite ok. Over built significantly.
#25	40 x 30. Block 2 layers	N.A.	3.8	2100	3	1.4	1.7	Balling, cannot deposit. Nozzle burned out.

data lost