Outline

- Important updates

- Feedback on Assignment 3

- Case study

- Feedback & Questions

Important updates

- **Computational training for week 4-6 will be optional.**
  - *Slides/Videos will be available online for self-learning.*
- **Lectures:**

Week 5 (Nov 29 – Dec 5)	• *L9-Nov 29: Processing of metals* • *L10-Nov 30: Ceramic*
Week 6 (Dec 6 – 12)	• *L11-Dec 7: Physical properties of materials and sustainability* • *L12-Video: Review lecture* • *No lectures on Dec 6 & 10* • *Final Exercise/Q&A: Dec 9*

- **The grading weight of assignment will be accordingly modified.**
  - *A1-A3, 8 points*
  - *A4-A5, 5 points*
  - *A6, 6 points*
  - *In total, 40 points for 6 assignments. Your final grades will be accordingly updated in MyCourses system.*
- **Q/A session on Tuesdays will be merged with the exercise session on Thursdays.**
- **The case study will be open this week.**

Review lecture

- 26 self assessment
- Review lecture: L12-Video will be published in the last week.
- Address any questions from lectures / exercise / assignment / textbook on concepts / terms / equations / approaches / etc.
- Propose your questions here: www.menti.com, code: 78809152, multiple submission is allowed.

Assignment - General rules

Q&A

- Please avoid emails and use the "General discussion" on MyCourses!
- Please check the existing topics in "General discussion" before proposing a new one.
- Reply: Mondays, Tuesdays, Thursdays.
- Face-to-face Q&A time: Exercise session.

Timelines

- Open on MyCourses: every Monday before 18:00.
- Deadline: every Sunday at 18:00 to MyCourses.
- Cut-off deadline: every Tuesday at 16:00 to MyCourses.
- Solution open on MyCourses: every Tuesday at 16:30.
- For the last assignment (A6), no extension and later submission allowed, solution will be given on MyCourses before 18:30, 12.12.2021.

Assignment - General rules

Submission rules

- Only PDF type file is accepted for submission, please summarize all your answers/solutions in **one PDF file for every assignment**.

- Please name your assignment files with the assignment number and your first name and surname, and link them with short underlines: '**ANr_Firstname_Surname.pdf**', e.g. for the first Assignment 'A1_Wenqi_Liu.pdf'.

- It is appreciated to **sort the PDF pages in the TaskNr order**, which is helpful to speed up the evaluation process.

- Learning Group work is encouraged for this course. You could form a group with **max one additional peer** to review the lecture/exercise content and discuss the tasks in the assignment. After discussion, please **finish your assignment independently** and submit your individual report. Please note the **duplicate report is not accepted!** If you have a learning group, please **indicate who your group member is** in the submitted report. In addition, clearly state the individual contributions of each group member.

Assignment - General rules

- When required, always show the step-by-step derivation or calculation processes, without which hinting the number does not qualify for grades.
- When required, always give a brief and concise explanation or description, without which hinting the right choice or answer does not qualify for grades.
- **Citation is necessary** if you are using any figures/data that are not generated by yourself.
- Handwriting/plotting is acceptable, just **make sure that your handwriting/final photo in the system is clear enough, otherwise it may affect the grading for details/calculation process.**

Grades

- Delayed submission will be subjected to a penalty function in an exponential relation with time.
- Full points: 100 for every assignment, which will be calculated as 5-8 points in the final grade system. The weighted pointes will be indicated in each assignment. In total, 40 points for 6 assignments.
- Tolerant grading, high points ≠ exactly accurate answers!
- Check the assignment solution carefully! This is the only standard answer (for calculations, equations, derivations, definitions) if there are similar questions in the exam.
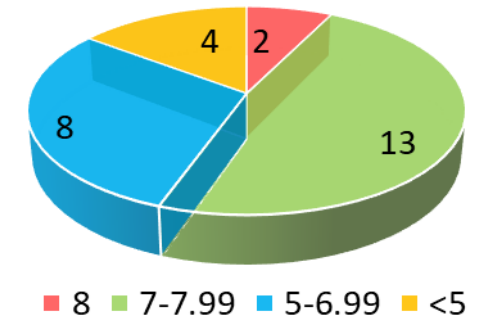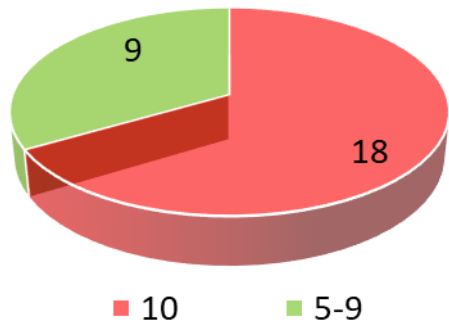
Assignment 03 - Summary

Submission: 27
Full points: 100, is calculated as 8 points in the final grade system.
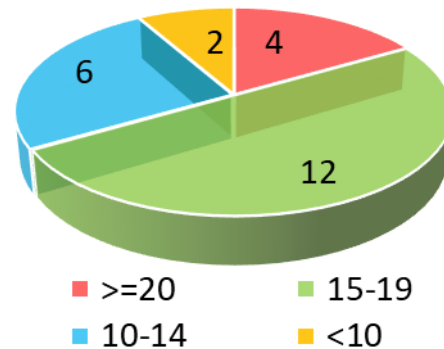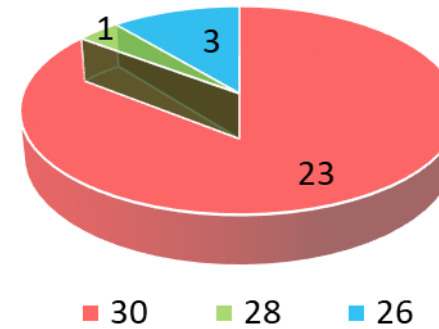Due date: 18:00 PM, 21.11.2021 (One delayed submission)

Summary

- 8
- 7-7.99
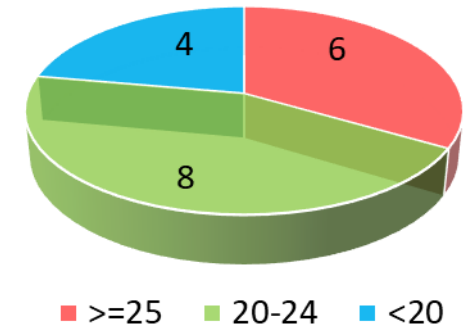- 5-6.99
- <5

Task 1: 27, 10 points

- 10
- 5-9

Task 2: 24, 20 points

- >=20
- 15-19
- 10-14
- <10

Task 3: 27, 30 points

- 30
- 28
- 26

Task 4: 18, 25 points

- >=25
- 20-24
- <20

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Charpy test results and characteristic values
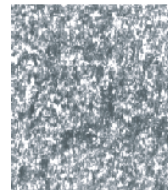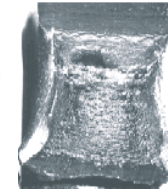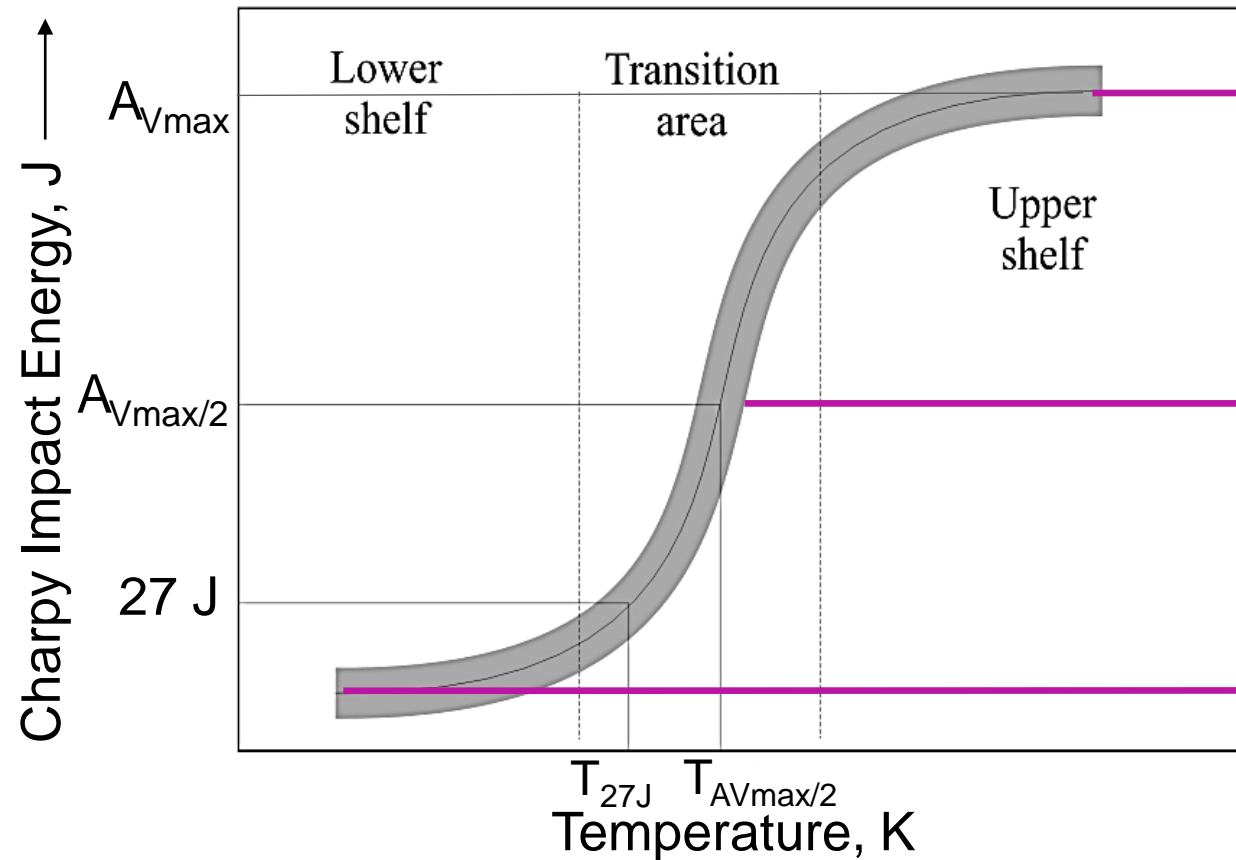
Characteristic values

- The temperature at which a certain amount of impact energy is reached, e.g. T_{27J}

- Ductile Brittle Transition Temperature (DBTT): $T_{AVmax/2}$

- Upper shelf toughness: A_{Vmax}

Charpy test results and characteristic values

Top

Slope

Middle point
DBTT

Bottom

Upper shelf toughness

$$y = Bottom + \frac{Top - Bottom \times 2}{1 + \exp(\frac{Middle\ point - x}{Slope})}$$

Charpy test

high strength/ductility fcc

low strength/ductility fcc

- Exp.
— Fit
— FCC
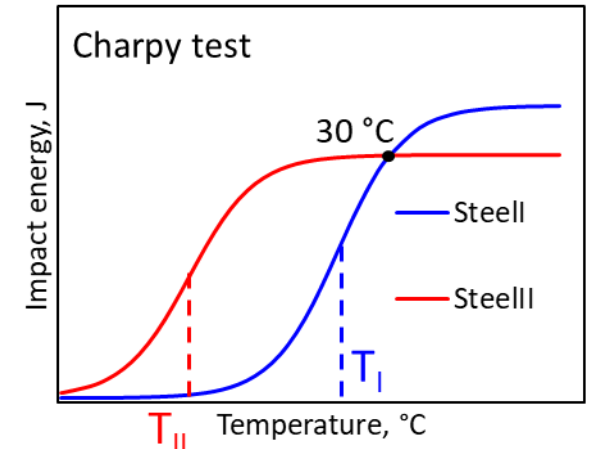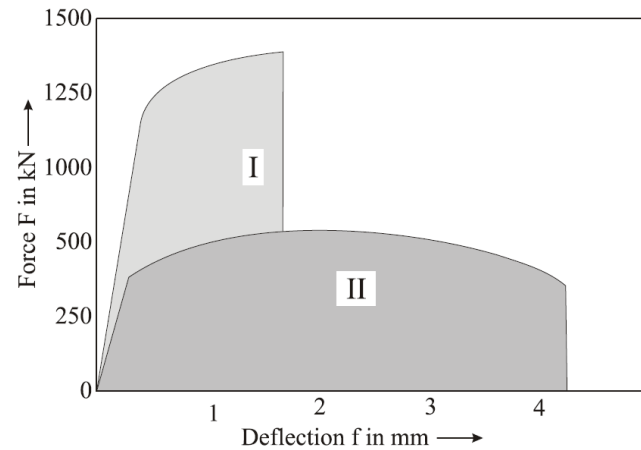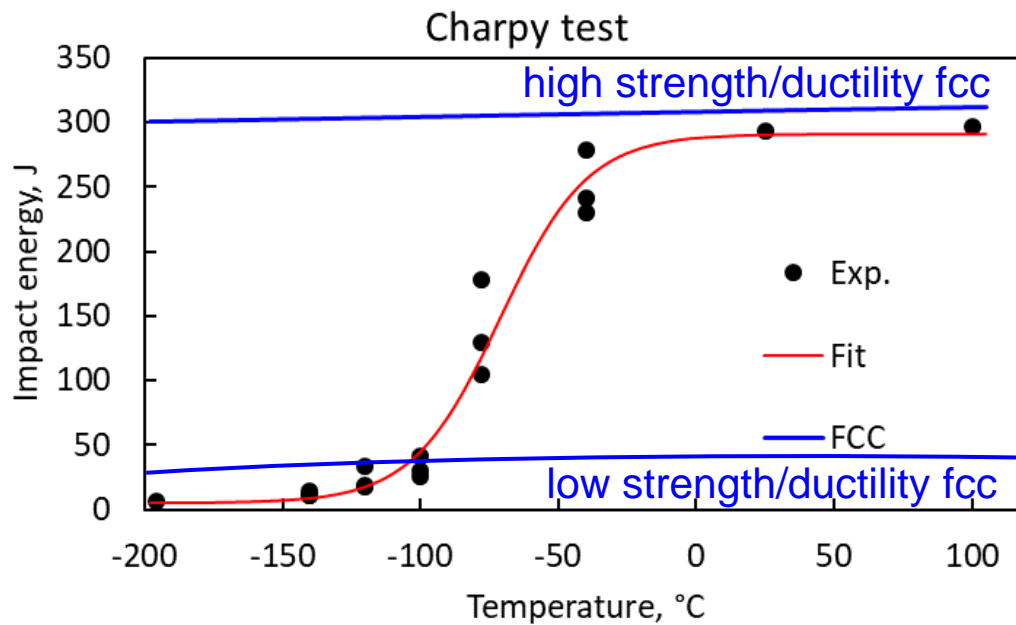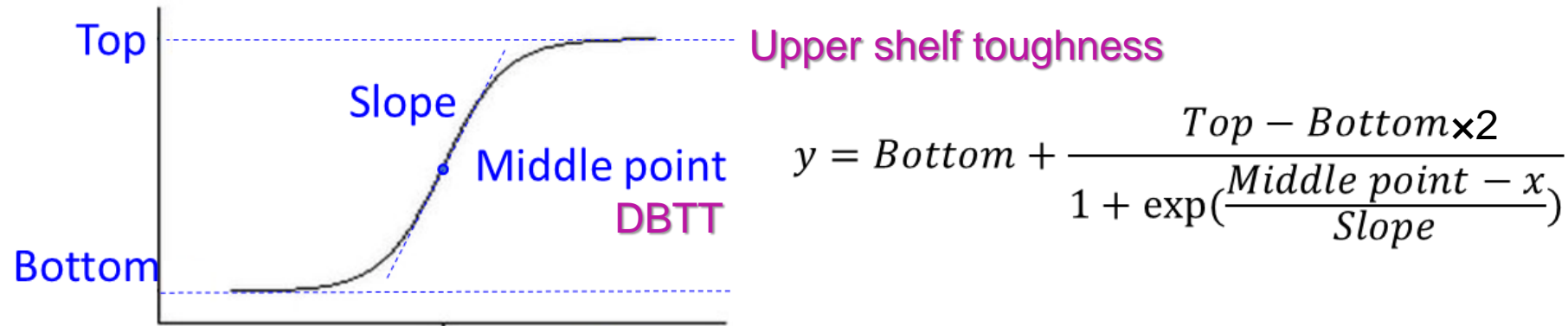
Case Studies

Case Study I - Microstructure modeling
- Analyze the microstructure information of the EBSD data and create an RVE.

Case Study II - Scientific article reading and summary
- Search articles online in the focused research fields of steel, read, and write an essay to summarize the articles.

Details in MyCourses - Case studies

- *Group work is allowed for Case Study 1. You could form a group with **max. two additional peers** to solve the task and provide your solution. For the convenience of grading, still submit your report individually, but indicate who your group member is. In addition, clearly state the **individual contributions** of each group member.*

- *Group work is **not** allowed for Case Study 2. **Please finish this task independently and submit your own report.***

- Common due date: 18:00 PM, 19.12.2021

- Extra 5 points for each case study in the final grading system.

- *All information has been given in the task description files. As the additional case study to obtain extra points in the course, no more additional supports/resources would be given.*

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Case Study 1 - Microstructure modeling

- *Group work is allowed for Case Study 1. You could form a group with **max. two additional peers** to solve the task and provide your solution. You can submit the report in a group and clearly indicate who your group member is. In addition, clearly state the **individual contributions** of each group member.*

Analyze the microstructure information of the given EBSD data of a high entropy alloy (HEA) (ebsdHEA.ctf). The focused features shall be grain size and shape distribution. Use the statistical microstructure information to generate an RVE for the investigated HEA material. Analyze the microstructure information of the generated RVE (http://www.dream3d.io/Filters/ImportExportFilters/LosAlamosFFTWriter/), assess and improve the representativeness of the generated RVE.

Expected results:

- The detailed analysis of the grain size and shape distribution functions and fitting.
- The procedure and results of the RVE model generation.
- An algorithm to analyze the grain size and shape distribution of the generated RVE.
- An algorithm or workflow to optimize the quality of the representativeness of the RVE model.
- Any automation algorithm of the entire process.

You might get some further information from the following papers:
W. Liu, J. Lian, N. Aravas, S. Münstermann, A strategy for synthetic microstructure generation and crystal plasticity parameter calibration of fine-grain-structured dual-phase steel, International Journal of Plasticity 126 (2020) 102614.

input: EBSD data
output: RVE data
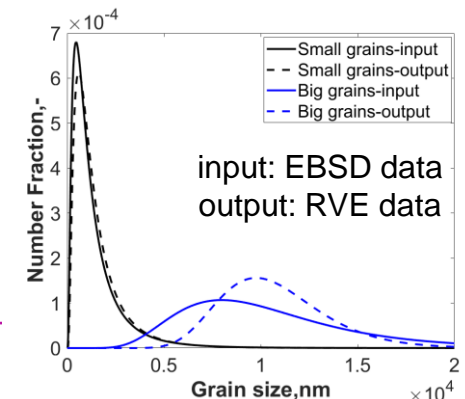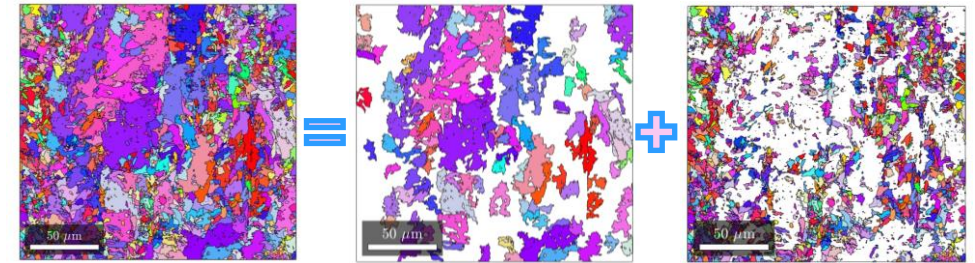
Case Study 2 - Scientific article reading and summary

***Group work** is not allowed for Case Study 2!*

- Only focus on steel.
- Search articles online in the focused research fields of **steel**, read, and write an essay to summarize the articles.
- Pick up one topic/keyword from each of the fields in the Table. Then for each topic, select an article for intensive reading and summary.
- The selected articles can be mainly focused on or partly involving the picked topic/keyword.
- The selected articles shall be only from the given Journal list.
- Focus on the recent researches.

Requirements:
- Summarize all contents in one PDF file, with naming 'CS2_Firstname_Surname.pdf'.
- One A4 page for one article. The template is given in the WORD file.
- One article for each topic/keyword. One topic/keyword from each field. In total, 2 pages for 2 selected articles.
- Give the full citation information of the selected article.
- Attach the original PDF files of the selected articles.
- Directly copy and paste is not accepted. Summarize the article content in your own words.

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Case Study 2 - Scientific article reading and summary

Table: Interesting topics/keywords in **Steel** research.

Field 1	Field 2
Microstructure characterization	Microstructure effect on plastic deformation
Damage mechanism	Fatigue property evaluation
Strengthening mechanism	Additive Manufacturing techniques
Fracture mechanics	Strain rate effect on ductile fracture

Journal list:

- Nature Reviews Materials (https://www.nature.com/natrevmats/)
- PROGRESS IN MATERIALS SCIENCE (https://www.journals.elsevier.com/progress-in-materials-science)
- NATURE MATERIALS (https://www.nature.com/nmat/)
- MATERIALS SCIENCE & ENGINEERING R-REPORTS (https://www.journals.elsevier.com/materials-science-and-engineering-r-reports)
- Annual Review of Materials Research (https://www.annualreviews.org/loi/matsci)
- ADVANCED MATERIALS (https://onlinelibrary.wiley.com/journal/15214095)
- Materials Today (https://www.journals.elsevier.com/materials-today)
- ACTA MATERIALIA (https://www.journals.elsevier.com/acta-materialia)

- You can also find the scientific articles from the following Journal database: https://www.sciencedirect.com/, https://scholar.google.fi/. Please login with Aalto IP to obtain access.

- Case Study Deadline: 18:00 PM, 19.12.2021

Resources

Materials:

- Wolfgang Bleck, Materials Science of Steel, Aachen, 2016, 4th ed.
- Wolfgang Bleck, Materials Characterisation, Aachen, 2017, 3th ed.

Questions?

- **Assignment** submission DL is **18:00 on 28.11.2021.**

- Use the Zoom Chat function or raise your hands!

- Please avoid emails and use the "General discussion" on MyCourses!

- Please check the existing topics in "General discussion" before proposing a new one.

Slides will be uploaded after Exercise.

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