Chapter 2. Cyclic deformation in ductile single crystals

Read: 2.1, 2.2, 2.3, 2.4, 2.5 not 2.5.1, 2.7 (principles), 2.8, 2.11, 2.12 (introduction)

1) What is cyclic saturation.

2) What is the cyclic stress-strain curve. How is it constructed ? Why is there a plateau? What distinguishes cyclic and monotonic loading

3) Describe the various dislocation structures that arise from cyclic loading of FCC single crystals, and how they arise.

Chapter 3. Cyclic deformation in polycrystalline ductile solids

Read 3.1, 3.3, 3.6, 3.7, 3.9

1) Why is the cyclical behavior different for polycrystalline materials when compared with single crystals?

2) Define the following concepts and explain the mechanisms behind them.
- cyclic hardening
- cyclic softening
- the Bauschinger effect
- shakedown

Chapter 4. Fatigue crack initiation in ductile solids

Read: 4.1, 4.2, 4.3, 4.4, 4.6, 4.7, 4.8, 4.9, 4. 1 0, 4.11

1) Why does surface roughening occur during fatigue? What are extrusion, intrusion and protrusion? Why does the volume increase?

2) Why does the occurrence of surface roughening initiate cracks? Two mechanisms.

3) Describe how the crack initiation is effected by the surrounding environment.

4) Are grain boundaries good or bad regarding crack initiation?

5) Initiation in commercial alloys differs in some aspects. Which? What special environmental aspect is added?

6) Crack initiation can occur during compressive loads. How does it work? What can it be used for?

Chapter 10. Fatigue crack growth in ductile solids

Read: 10.1, 10.2, 10.3, 10.4, 10.5, 10.6

1) How does the R-ratio influence the crack propagation rate and thresholdvalue?

2) Why is the crack propagation different in figure 10.2 when compared to figure 10.3?

3) What are striations and how are the generated? Is striations always formed during fatigue?

4) What is generally the difference if a fatigue experiment is performed in vacuum instead of air? Explain.

5) The fatigue sequence can be divided into three regions. What characterizes these regions? (table 10.1)

Chapter 14. Retardation and transients in fatigue crack growth

Read: 14.1, 14.1-14.2.1, 14.3-14.3.1, 14.4, 14.7, 14.12-14.12.2, 14.13, 14.14-14.14.1

1) What is crack closure?

2) What different types of crack closure exists?

3) How does crack closure influence the crack propagation rate and threshold value?

4) What is the connection between crack closure and R-value?

5) How do you take crack closure into account during calculations, e.g. In Paris law?

6) What happens during over- and under-loads, separately or in blocks?

Chapter 15. Small fatigue cracks

Read: 15.1, 15.2, 15.3, 15.4-15.4.2, 15.7, 15.8

1) What are small cracks, which different definitions exists?

2) Why is there a large interest for short cracks?

3) How does the propagation of short and long cracks differ?

Chapter 16 Environmental interactions

Read: 16.1, 16.2, 16.3

1) What is corrosion fatigue? What mechanisms are available? How is the corrosion rate influenced?

2) How can we take into account the corrosion fatigue in models for crack propagation.