(1) Explain what is work hardening rate? What information you can obtain from this parameter?

6 points

(2) Describe the factors which can affect the recrystallization process of a metal. Explain the reasons.

9 points

(3) Explain the following terms: (a) Graphene, 3 points; (b) Schockley partials, 3 points; (c) Schottky defect, 3 points; (d) Eutectoid reaction, 3 points; (e) Fracture toughness, 3 points; (f) Flexural strength, 3 points; (g) Thermal fatigue, 3 points; (h) Extrinsic semiconductor, 3 points; (i) Glass transition temperature, 3 points; (j) Partially stabilized zirconia, 3 points.　　30 points

(4) Consider a single crystal of some hypothetical metal that has the BCC crystal structure and is oriented such that a tensile stress is applied along a [1 1 2] direction. If slip occurs on a (0 1 1) plane and in a [1 -1 1] direction, compute the stress at which the crystal yields if its critical resolved shear stress is 9.2 MPa　　7 points

(5) Ni and Ni_3Al have the same FCC structure, but the X-ray diffraction peaks from them are quite different. Explain the reason for this. Note: in Ni_3Al, Al atoms occupy the face centered positions.

7 points

(6) List the names of 6 phases which are often formed in steels.　　7 points

(7) Give schematic drawings of (a) coherent, 2 points; (b) semicoherent, 2 points; and (c) incoherent interface, 2 points.　　6 points

(8) Over the last few decades, the production of jet engine turbine blade was developed from polycrystalline grains, to orientated columnar grains, then to single crystal. Explain the reason for this development.　　7 points

(9) Describe the preparation procedure of a specimen, which is for metallographic observation under an optical microscope.　　7 points

(10) Yield drop may occur in the stress-strain curve of some materials. Why yield drop occurs?

7 points

(11) There are two types of nucleation process during phase transformation, one is homogeneous nucleation and the other one is heterogeneous nucleation. Use no formula to explain why heterogeneous nucleation is always easier than homogeneous nucleation.　　7 points