Homework 1 (20 points)
Due date: Oct 12th (Thu), 2023

1. What are the principles for selecting X-ray tubes and filters in experiments? Given a sample with Fe as the main component, how to choose a suitable X-ray tube and a suitable filter?

2. Below are several crystal planes of a specific cubic crystal system material. Try to rearrange their interplanar distances in order from largest to smallest（100），（200），（121），（111），(220)，（130），（030），（110）.

3. What is the physical meaning of multiplicity factors? What is the multiplicity factor of {100} for a specific cubic crystal? If the crystal transforms into a tetragonal crystal system, what will happen to the multiplicity factor of this crystal face family? Why?

4. The relationship that determines the intensity of X-rays is:

$$I = I_0 \frac{\lambda^3}{32\pi R}\left(\frac{e^2}{mc^2}\right)^2 \frac{V}{V_c^2} P|F|^2 \phi(\theta)A(\theta)e^{-2M}$$

Please explain the physical meaning of each parameter in the formula.

5. What do d, θ, and λ in Bragg's equation 2dsinθ = λ represent? What is Bragg's equation used for?

6. Describe the steps of X-ray diffraction phase analysis. What issues should be paid attention to during identification?

7. What kinds of internal stresses may exist in a cold-rolled steel plate? What are the characteristics of their diffraction spectra?