HW#5 due October 25

1. The expressions for Burgers vectors for FCC and BCC crystal structures are of the form

$$\mathbf{b} = \frac{a}{2}\langle uvw \rangle \qquad \mathbf{b}(\text{FCC}) = \frac{a}{2}\langle 110 \rangle \quad \mathbf{b}(\text{BCC}) = \frac{a}{2}\langle 111 \rangle$$

where *a* is the unit cell length. The magnitudes of these Burgers vectors may be determined from the following equation:

$$|\mathbf{b}| = \frac{a}{2}(u^2 + v^2 + w^2)^{1/2}$$

Determine the value of $|\mathbf{b}|$ for Cu and Fe. (a(Cu, FCC)=0.1278 nm), a(Fe, BCC)=0.1241 nm)

2. Consider a single crystal of some hypothetical metal that has the FCC crystal structure and is oriented such that a tensile stress is applied along a [112] direction. If slip occurs on a (111) plane and in a [01-1] direction, and the crystal yields at a stress of 5.12 MPa, compute the critical resolved shear stress.

3. Consider a hypothetical material that has a grain diameter of 2.1×10^{-2} mm. After a heat treatment at 600 °C for 3 h, the grain diameter has increased to 7.2×10^{-2} mm. Compute the grain diameter when a specimen of this same original material is heated for 1.7 h at 600 °C. Assume the n grain diameter exponent has a value of 2.

4. Explain simply how four strengthening strategies work.
(grain size reduction, solid-solution, precipitation, cold work)

5. What is the driving forces for recrystallization and grain growth?