Homework 4

Due – 11:59pm Feb. 12th

1. For this homework, I want you to keep a journal or notebook of your work to learn how to use MTex (inside Matlab). Be thorough in documenting the work. If all you do is to paste a series of pictures into the document you will lose points. To ensure that you receive full credit, give explanations of each step and what your interpretation is of each result. It does not have to be exactly correct in this exercise – I mainly am interested in seeing you learn how to use the mtex analysis tool. Later on we will review the textures that are typically found in metals and calculate the anisotropy of their properties. In fact some basic tools are found in MTEX, such as elastic anisotropy.

1A. [35] Input the ALR.EPF set of pole figures and analyze them to obtain the ODF, plot pole figures, inverse pole figures, phi2 sections, and a 3D plot. Comment on the texture and compare to what you can find in the notes or in the literature on rolled fcc metals, this being a rolled aluminum alloy.

1B. [35] Input and analyze the EBSD dataset called fw-ar-IF1-avtr12-corr.ctf. Make a plot of the microstructure with and without grain boundaries. Plot pole figures, inverse pole figures, ODF sections and 3D view of ODF. Comment on the texture and compare to what you can find in the notes or in the literature on rolled bcc metals since this is a rolled interstitial-free steel.

2. In addition to the MTEX exercises, answer the following questions. Two or three sentences should be sufficient.

2A. [5] How is an x-ray pole figure measured?

2B. [5] Why does a pole figure not provide complete orientation information for the texture of a polycrystalline sample?

2C. [5] Why does an experimental pole figure not correspond to a theoretical one at the edges?

2D. [5] Explain why the entropy associated with a texture is zero for a perfectly random texture and increases with the texture strength. Comment on whether this makes physical sense to you i.e. that the most random condition corresponds to zero entropy.

2E. [5] Write in your own words why it is important to compare the measured against the re-calculated pole figures when assessing the quality of an OD(F) calculation.
2F. [5] We have seen that the (001) pole figure can be obtained directly from the OD by integrating over the third Euler angle. Explain why the [001] inverse pole figure can be, equivalently, obtained by integrating over the first Euler angle.