**File Descriptions for sd.eps.4**

Following are descriptions of the contents of the files included at this site in association with the PhD dissertation of Ellen J Crapster-Pregont (Constraining the Chemical Environment and Processes in the Protoplanetary Disk: Perspective from Populations of Calcium-and Aluminum-rich Inclusions in Ornans-group and Metal-rich Chondrules in Renazzo-group Carbonaceous Chondrites). All .zip files contain either a directory of image files (in .tif format) or a group of .csv files that correspond to the separate tabs/sheets in the identically named .xlsx file.

Please contact the author, Dr. Ellen Crapster-Pregont (ellenjcp@gmail.com) if you have any questions or would like to request different files or data.

**metal\_element\_maps** –.tif files:

Contains all electron probe microanalyzer (EPMA)-generated element x-ray intensity maps for refractory inclusions and chondrules considered in this study. All of these files are renamed, raw, 32-bit files from the EPMA. These maps were used to generate the element comparison data specifically the transects using the freeware FIJI (ImageJ). All chondrule and metal nodule files are named as follows: chondrite name-section identifying info-chondrule letter-metal nodule number\_element. There are also element x-ray intensity maps for areas covering the entire chondrule. Elements include: Fe, Co, S, Ni, Al, Ca, Mg, Na, Si, and Ti. There is a subfolder (‘EPMA\_BSE’) that contains 8-bit, EPMA-generated, backscattered electron (BSE) images of the metal nodules. Additional subfolders (‘SEM\_BSE’ and ‘SEM\_SE’) contain scanning electron microscope (SEM)-generated BSE and secondary electron (SE) images. The SEM-generated images were obtained both before (pre-) and after (post-) EPMA elemental analysis and are shown in Figures AE.2.1 through AE.2.6 for individual metal nodules in chondrules (post-EPMA), the high-resolution images in AE.3.1 (pre-EPMA), and Figures 4.8 and 4.9 (pre-and post-EPMA) of the dissertation. The addition of ‘-zoom’ to the file name indicates that this image was taken at higher magnification and only includes part of the metal nodule. All SEM-generated BSE images have had the brightness and contrast adjusted such that only the metal, and its internal variation, are clearly visible. In select cases, SEM-generated BSE images are more traditional (include ‘-general’ in the file name) and have the brightness and contrast set to see the variation in the silicate minerals and the general location of the metal relative to the silicates and oxides.

**metal\_RGB\_composites** – .tif files:

Contains assorted red-green-blue (RGB) three element x-ray intensity map composite images. All inclusion files are named as follows: chondrite name-section identifying info-nodule number\_element combination in RGB order. Element combinations include: FeNiS, TiCaAl, FeSiMg, MgSiFe, etc. An example RGB composite, FeNiCo, is included in Figures 4.11 to 4.14 for the individual metal nodules analyzed in this dissertation.

**EBSD\_images** –.tif files:

The electron backscatter diffractometer (EBSD) produces a number of different products. This file contains directories of the EBSD image datasets relevant to this dissertation. Within each directory, the files are named as follows: chondrite name-chondrule letter-metal nodule number\_directory name (‘\_grainboundaries’, ‘\_grainsize’, ‘\_IQ’, ‘\_indvgrains’, ‘\_IPF’, or ‘\_twinangles’). For naming, the ‘misorienation\_maps’ directory has been further subdivided by the type of misorientation map within the folder, as such, that abbreviation (‘\_GOS’, ‘\_LOS5’, ‘\_LOS10’, and ‘\_GROD’) replaces that of ‘directory name’ designated in the naming scheme. Each of these directories is described below. Most contain images from a majority of the metal nodules studied and some contain overview chondrule images.

The ‘grain\_boundaries’ directory has images highlighting the different grain boundary types: low angle (yellow; <5°), high angle (green; >15°), and coincident site lattice (red; where atoms from adjacent grains occupy the same site). These grain boundary images are used in Figure AE.7.1.

The ‘grain\_size’ directory has images where each grain has been assigned a color using a scale based on grain size, or area, ranging from white (small) to red (large). Grain size images are incorporated into Figures 4.11 through 4.14.

The ‘image\_quality’ directory contains images representing the quality of the EBSD measurements and the smoothness of the surface being analyzed. These are greyscale images where color is determined by surface smoothness and the confidence of the software at identifying the kikuchi pattern (which defines the orientation of the crystal lattice) at a given point. Lighter or brighter areas represent high quality and darker or black indicate low quality or no signal. These images are in Figures AE.5.1 and AE.5.2. The difference in quality of the analyses done with and without a carbon coat are shown in Figure 4.10. See text for more discussion.

The ‘individual\_grains’ directory has images where each unique metal grain in the chondrules and nodules studied has been randomly assigned a color. Maps of individual grains are incorporated into Figures 4.11 through 4.14 in individual metal nodules.

The ‘inverse\_pole\_figure’ directory contains the inverse pole figures (IPF) which is a color representation of the crystal lattice orientation at a given point as indicated by the color. See ‘IPF\_legend.tif’ for the definition of which color indicates which crystal lattice orientation (this is Figure 4.1). Figures AE.6.1 through AE.6.9 include the whole chondrule metal IPF and Figures 4.11 through 4.14 incorporate IPF images for individual metal nodules.

The ‘misorientation\_map’ directory contains four subdirectories each with a different misorientation map type: ‘GROD’ (grain reference orientation deviation where reference is grain average orientation; Figure AE.8.3), ‘LOS5’ (local orientation spread with maximum angle of 5 degrees), ‘LOS10’ (local orientation spread with maximum angle of 10 degrees; Figure AE.8.2), and ‘GOS’ (grain orientation spread; Figure AE.8.1). Color scale legends are defined in corresponding figures in the dissertation as well as in the ‘misorientation\_map\_key’ files. Selected misorientation maps are also shown in Figure 4.17.

The ‘twin\_angle’ directory has IPF maps where colored points indicate the locations where specific grain boundary, specifically twined boundary, angles are measured. Adjacent points across the grain boundary show where the angle is measured (Figure 4.16). The key to point color and measured angles can be found in the “twin\_angles” tab (or .csv) of the ‘metal\_data’ files.

**misorientation\_map\_key** – .xlsx and .csv file:

Table with the minimum and maximum angle values corresponding to the various misorientation maps. These values correspond to a scale from bluest (smallest angle) to reddest (largest angle). Visual versions of these scales are in Figures AE.8.1 through AE8.3.

**metal\_data** – .xlsx and grouped .csv files:

This file (files for .csv) compile the numerical data associated with the analyses on metal in the chondrite Acfer 139 (CR2). Each tab (sheet) or file (for .csv), contains different information used to generate the figures, tables, and interpretations presented in the associated dissertation.

The “average\_element\_wt%” tab contains the EPMA, PAP corrected, quantitative analyses for the metal nodules considered in this study. These values are averages of individual points with totals >97% and represent the values reported in Tables 4.2, 4.4, 4.5, 4.6, AE.4.2, and AE.4.1. These values are used to calculate the element ratios considered in some tables and figures. The location of each EPMA elemental analysis is labeled in AE.2.1 through AE. 2.6 and were verified with BSE images obtained after EPMA analysis. Further descriptions of the data can be found in the individual tabs (or .csv files) or in the dissertation.

The “element\_transects” tab records the EPMA measured values for transects (lines of quantitative point analyses) used to create Figure 4.7. These element wt% values, and the Co/Fe and Ni/Fe ratios, are listed for each point in each transect in each metal nodule.

The “grain\_data” tab records the information output from the EBSD software and includes information related to number and area of grains in metal nodules, number of neighboring grains, misorientation, image quality, and fit parameters of the kikuchi pattern. These values are incorporated into various tables (summary and general information) and are visually represented in figures such as the misorientation maps.

The “twin\_angles” tab contains the measured angles across various grain boundaries in select metal nodules in Acfer 139 that are reported in Table 4.8. These boundaries are suspected twinned grains. Each numbered or lettered measurement is color coded. Locations of these analyses can be found in the images in the ‘twin\_angle’ director of ‘EBSD\_images’. These values and corresponding IPF images are the basis for Figure 4.16.

The “twin\_data” tab contains a summary of information compiled from EBSD data. Some of these values are from the “grain\_data” tab and the “twin\_angles” tab. These values serve as a compilation (some information included in Table 4.7).

The “grain\_twin\_summary” tab is another summary of EBSD-generated data including number of grains in a metal nodule, average size of grains in a metal nodule, and twinning information. Abbreviations are defined above the corresponding column heading. These values or information are incorporated into several tables in the dissertation.

**3D\_visualization\_videos** – .avi and .mp4 files:

Computed tomography (CT) data is often easier to view in video form. The file ‘Acfer139-CT’ is short representation of the processed CT data where denser materials appear lighter (whiter) and less dense materials are darker. These data allow for minerals of different density to be easily separated using thresholding of the greyscale values. The file ‘Acfer139-CT\_shaded metal’ is an example of the CT data where the metal associated with the chondrules considered in this dissertation have been thresholded and assigned unique colors based on which chondrule they are associated with. This visualization permits the metal-chondrule association to be clearly seen. A single plane of the CT data, representing the surface on which the cut was made and EPMA and EBSD analyses were conducted, is shown for reference. A still image from this video is used for Figure 4.3.