CARBONACEOUS CHONDRITE THIN SECTION PREPARATION.

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Introduction: Carbonaceous chondrite meteorites have long posed a challenge for thin section makers. The variability in sample hardness among the different types, and sometimes within individual sections, creates the need for an adaptable approach at each step of the thin section making process. This poster will share some of the procedural adjustments that have proven to be successful at the NASA JSC Meteorite Thin Section Laboratory. These adjustments are modifications of preparation methods that have been in use for decades and therefore do not require investment in new technology or materials.

Since 1987 the NASA Astromaterials Curation Meteorite Thin Section Lab has prepared sections of 180 CV3, 40 CH, 55 C ungrouped, 156 CK, 35 CM1, 43 CM1/2, 375 CM2, 172 CO3, 16 CR1, and 206 CR2, for a total of 1278 carbonaceous chondrite thin sections prepared for scientists.

Sample Preparation: The practice of epoxy impregnation of carbonaceous chondrite material is essential for the mitigation of grain/clast plucking and various forms of wedging (1). All of the sample chips that are prepared for sectioning at JSC receive the same initial epoxy impregnation when they are molded into a potted butt, or PB. Carbonaceous chondrites, and other delicate samples, are given an additional impregnation with epoxy on the exposed surface each time new material is exposed.

Once the PB is faced and polished flat, it is warmed along with the epoxy mixture on a hot plate at 110º F prior to application of the epoxy to the PB. This reduces the viscosity of the epoxy thus allowing deeper penetration of epoxy into the sample. The wetted PB is then placed into a vacuum chamber where it is pumped down to -28 in Hg for five to ten minutes. The PB is then removed from the vacuum and a clean glass slide is mounted to the epoxied surface. After curing on the hot plate for 24 hours, the section is cut off to a thickness of 300 microns using a Buehler low speed diamond saw. It is then ground to a thickness of 200 microns using an Ingram section grinder equipped with a 320 grit silicon carbide grinding wheel.

Lapping: The section is now lapped on an optically flat lapping wheel that is fitted with 400 grit silicon carbide lapping film. 190 proof ethyl alcohol is applied to the lapping film as a lubricant during the lapping process. A light touch and frequent thickness checks with an outside micrometer are critical at this step in order to prevent or correct sample wedging. The sample should also be checked with a microscope for any grain or clast plucking during this stage and subsequent polishing steps. If plucking is evident, then the sample is reimpregnated with epoxy prior to continued lapping and polishing. Lapping is complete when the section is flat and within 30 microns of the desired final thickness.

Final Polishing: Cleanliness is paramount when attempting the final polish of carbonaceous chondrites because one stray grit can scratch these perilously soft samples beyond repair. The section should be ultrasonically cleaned for 10 seconds in 200 proof ethyl alcohol in between all of the lapping and polishing steps. It is most helpful to keep the lapping wheel area clean and to blow off the polishing paper with compressed air immediately prior to use.

The section is polished on an optically flat lap wheel that is covered with 100% cotton polishing paper that has been lightly charged with 6 micron diamond paste. The key for polishing carbonaceous chondrites is very light usage of polishing paste and absolutely no use of polishing oil. Lapping wheel speeds should be kept under 200 rpm for this 'dry' style of polishing in order to keep sample heating to a minimum. Once the sample is within 5 microns of final thickness, it is then polished on 100% cotton polishing paper that is charged with 1 micron diamond paste. Polishing at this stage should be done with a very light touch in order to avoid wedging and excessive relief between hard grains/clasts and soft matrix.

Allocation: Antarctic meteorite thin sections prepared by the Astromaterials Curation Office have been allocated for research by scientists who use a wide variety of techniques including Raman spectroscopy, scanning electron microscopy, transmission electron microscopy, electron microprobe analysis, secondary ion mass spectrometry, laser ablation ICP-MS, FTIR, and nano-SIMS. These methods have been employed for carrying out mineralogy, petrology, geochemistry, and chronology studies of carbonaceous chondrites.

References: [1]Moreland, Grover (1968) *The American Mineralogist* :53:2070-2074.