

CAN PROCESSES USED TO EXTRACT PRESOLAR GRAINS FROM METEORITES BE USED TO PROCESS GRAINS TRAPPED IN AEROGEL? G. R. Huss, Department of Geological Sciences, Arizona State University, Box 871404, Temp, AZ 85287-1404, USA. (gary.huss@asu.edu)

Introduction: Over the years, an extensive set of procedures based on chemical and physical properties of minerals have been developed to separate the known types of presolar materials from chondritic meteorites [e.g., 1-4]. While these procedures can be likened to burning down the haystack to find the needle, some aspects may be useful for handling samples trapped in aerogel. The utility of these methods will depend on the chemical resistance of the particle of interest, which could be determined in advance by non-destructive X-ray analysis or a related technique.

Chemical Dissolution: Depending on the nature of the material trapped in the aerogel, it may be feasible to dissolve away the aerogel and leave the particle behind. HF is particularly effective at breaking silicate bonds, converting SiO_2 to SiF_4 , which is a gas at room temperature. In meteorite studies, a relatively large amount of acid is used in many cycles, with the used acid removed by decanting or by pipette. This results in some losses of small particles due to adherence to the walls of the containers or inadvertent removal with used liquids. However, the procedure could be miniaturized, particularly if aerogel is not too complicated chemically. Note that the chemical oxidation originally used in test tubes by [1] to remove the "Q" noble gases in meteorites has been adapted to the vacuum inlet system of a noble-gas mass spectrometer [5].

Possibility #1: A small piece of aerogel containing the sample of interest could be placed on a gold or carbon substrate. HF (or other acids) could be added, drop by drop, and allowed to react and evaporate. Volatile reaction products would evaporate as well, but non-volatile products would precipitate onto the substrate. The procedure could be monitored by optical microscope (with care taken to protect the observer and microscope from the acid fumes). Ideally, the sample could be measured on the gold foil or graphite planchette where the processing took place. However, in some cases the sample might have to be transferred for analysis. Transfer could be accomplished either wet or dry depending on the size and characteristics of the sample.

Possibility #2: The aerogel and sample could be placed into a tiny Teflon container. Chemicals could again be added one or a few drops at a time. The main trick to this procedure will be to get the liquids to wet the sample so reactions can take place. Surface tension is a problem for tiny grains, so surfactants may be necessary. Under ideal conditions, it might be possible to centrifuge the container and remove the liquid with a

micropipette, leaving the sample in the Teflon tube. One potential problem is that unless the sample is relatively large (>10 microns?), the processing may have to be done largely "blind". However, if the procedure is carefully developed ahead of time, this need not be an insurmountable problem.

Surface Properties: The surface properties of materials become increasingly important in governing the behavior of particles as grain size decreases. For example, micron-sized grains will stick tenaciously to a substrate via Van der Waals forces. Once, to my horror, I inadvertently dropped one of my carefully mapped grain mounts (a stainless-steel "bullet" with a gold foil pressed into the top to hold the sample) and watched it bounce across the table. The grains had been deposited from a liquid and were not pressed into the foil. I put the mount back in SEM and found that none of the grains had moved from its previous location! Surface properties might be utilized to separate components of a trapped particle or simply to transfer the particle from place to place.

Separating Particles. Grain surfaces can be either hydrophilic or hydrophobic, which operationally means that some wet easily (hydrophilic materials) and others do not. Many carbon-rich compounds are hydrophobic and tend to float on aqueous acid solutions or stick to the container walls. Separating such materials might be as simple as adding a drop of distilled water. Hydrophilic would be swallowed by the drop, while hydrophobic materials would be kept outside.

Sample Transfer. One of the easiest ways to transfer tiny particles is to incorporate them into a drop of liquid and then transfer the liquid with a Teflon pipette. Liquids with low surface tension (e.g., isopropanol) wet the sample more easily, but they also can leave the sample behind as they evaporate. In contrast, water, which has high surface tension, can capture a particle within the droplet and can drag it along as a drop is moved or can pull particles into a pile as a drop evaporates.

Although the chemical and physical manipulations described above may not be required for many types of analysis, in certain cases they may be the only way to prepare a sample for analysis.

References: [1] Lewis R. S. and Anders E. (1975) *Science* **190**, 1251-1262. [2] Ott U. et al. (1984) *GCA* **48**, 267-280. [3] Amari S. et al. (1994) *GCA* **58**, 459-470. [4] Huss G. R. and Lewis R. S. (1995) *GCA* **59**, 115-160. [5] Wieler R. et al. (1991) *GCA* **55**, 1709-1722. Supported by NASA NAG5-11543.