AUGER SPECTROSCOPY AS A COMPLEMENT TO NANOSIMS STUDIES OF PRESOLAR MATERIALS.

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The NanoSIMS ion microprobe has proven to be an ideal tool for locating isotopically distinct circumstellar materials on a sub-micrometer scale in a variety of extraterrestrial materials [e.g., 1-4]. However, to completely characterize presolar phases it is essential to obtain chemical and mineralogical data beyond what the NanoSIMS can provide. Although this can be done in some cases with the transmission electron microscope (TEM), not all samples lend themselves to this analytical approach. Detailed investigations of the suitability of various analytical techniques have convinced us that scanning Auger spectrometry best complements the NanoSIMS by providing mineralogical information on a comparable spatial scale without the need for extensive sample preparation.

Auger spectroscopy is an electron beam technique that can be used for elemental imaging in a similar way as energy dispersive X-ray (EDX) analysis. The fundamental difference between EDX and Auger measurements lies in the size and location of the analytical volume from which elemental information is extracted. While the spatial resolution of EDX is around 1 µm, Auger spectroscopy can resolve elemental variations on a scale of tens of nm, which is more than sufficient for circumstellar oxide and silicate grains which are typically 200 – 500 nm in diameter [1].

We used Auger spectroscopy on several samples of interplanetary dust particles (IDPs) and primitive meteorites that had previously been searched for presolar phases with the NanoSIMS [5-7]. The NanoSIMS analysis areas were readily found with the Auger instrument, and by overlaying the (NanoSIMS) isotopic and (Auger) elemental raster images it was possible to positively locate the isotopically anomalous presolar phases in the high-resolution Auger images. In most cases, the presolar oxides and silicates could be recognized as elementally and/or structurally distinct grains within the sample matrix. Individual presolar grains were identified as SiC, corundum, hibonite, Mg-silicate or Fe-silicate [8], based on their C, O, Mg, Al, Si, Fe, Ca Auger signals. In some cases tentative initial classifications, based on NanoSIMS secondary ion intensities, had to be corrected. Detailed information about the isotopic and mineralogical compositions of presolar grains is important for providing clues about stellar nucleosynthesis and galactic chemical evolution, as well as about grain survival in the interstellar medium and in different solar system reservoirs.

Since the Auger measurements are non-destructive and can be done directly on the NanoSIMS sample mounts, Auger characterizations can be used routinely after (or between) isotopic measurements in the NanoSIMS. We plan to extend this multi-technique approach for further studies of presolar phases in meteorites, micrometeorites and IDPs.

References: [1] Nguyen A. N. and Zinner E. (2004) *Science* 303, 1496-1499. [2] Floss C. et al. (2004) *Science* 303, 1355-1358. [3] Messenger S. et al. (2003) *Science* 300, 105-108. [4] Mostefaoui S. and Hoppe P. (2004) Ap.J. 613, L149-L152. [5] Floss C. and Stadermann F. J. (2005) LPSC XXXVI, Abstract #1390. [6] Nguyen A. N. et al. (2005) *this volume*. [7] Floss C. and Stadermann F. J. (2004) LPSC XXXV, Abstract #1281. [8] Floss C. et al. (2005) *this volume*.