Isotopic compositions of small presolar dust grains

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The last ten years have seen the accumulation of a wealth of isotopic data on presolar dust grains obtained with the ion microprobe [e.g., 1]. Most of these measurements were performed on grains ≥1 µm in size. A new type of ion probe, the NanoSIMS, with its high sensitivity and high spatial resolution [2] offers the opportunity to analyse much smaller grains, in the size range typical for interstellar dust.

We have initiated a series of NanoSIMS presolar grain studies that exploit these new capabilities. In one example we have extended C and N isotopic measurements to much smaller SiC grains by analysing grains from Murchison separate KJB (grain diameters 0.25–0.45µm) and Indarch IH6 (0.25–0.65µm) [3]. The distributions of the C and N isotopic ratios are quite similar to those of larger (1.8–3.7µm) grains from Murchison separate KJG [4, 5], the only difference being a higher fraction of grains with 10<12C/13C<40. Indarch IH6 contains also Si3N4 grains and we tentatively identified some of them as presolar with isotopic characteristics similar to mainstream SiC grains.

Another study is concerned with O isotopic measurements of small spinel grains [6, 7]. The abundance of >1µm presolar spinels is very low and before the start of our study only 7 such grains had been identified. We analysed spinels from Murray CF (average size ~0.15µm), Murray CG (~0.45µm) and Murchison KIE (~0.5µm) and identified 30 presolar grains (Figure 1). The abundance of presolar spinel is ~3% among the smallest size fraction (CF), much higher than among larger grains.