Combined Isotopic, Microstructural and (S)TEM Investigations of Presolar Silicates

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Primitive carbonaceous chondrites contain tiny (nanometer to a few microns in size) dust grains that were formed in the stellar winds of massive (red giant branch-RGB or asymptotic giant branch-AGB) stars and in the ejecta of stellar explosions before our solar system was formed. These 'presolar' grains survived high energy processes that created our solar system and carry isotopic anomalies that are the fingerprints of parent stellar nucleosynthesis [1]. Isotopic, microstructural and chemical investigations of presolar oxygen-rich grains provide excellent opportunity to better understand stellar nucleosynthesis, grain formation environments and grain alteration processes in the interstellar medium and on meteorite parent bodies [2]. In this study, oxygen isotope mapping using the NanoSIMS resulted into number of oxygen anomalous silicate and oxide grains formed in different stellar sources, enable us to understand nucleosynthesis of massive stars.

Five AGB silicates and four supernova silicates were investigated using energy-dispersive spectroscopy (EDS) and high resolution electron energy loss spectroscopy (EELS) on the (S)TEM (Scanning and Transmission Electron Microscopy) that resulted into wide range of structural and chemical compositions of the grains, including a grain with core-shell structure. Our results provide novel insights into the grain condensation in stellar atmospheres and alteration processes on parent meteorites.

References:

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