Presolar Silicate Grains: Constraints on Solar System Processes and Stellar Nucleosynthesis

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Presolar silicates are among the most abundant type of stardust and have been identified in primitive meteorites, micrometeorites, interplanetery dust particles and samples returned from comet Wild 2 [e.g., 1]. Presolar grain studies provide information about grain formation in stellar environements, as well as nucleosynthesis and stellar and galactic evolution. However, these grains can also be used as tracers of pre-accretionary alteration and/or parent body processing. This is particularly true for presolar silicates, which are more susceptible to secondary processing than other, more refractory, presolar grains [e.g., 2].

Abundances of presolar silicate provide information on the alteration experienced by the parent meteorites and their subcomponents. For example, fine-grained rims around chondrules in CO3.0 chondrites have similar presolar SiC abundances as interstitial matrix areas in the same meteorite, but have lower presolar silicate abundances [3]. This difference is likely due to destruction or re-equilibration of the oxygen isotopic compositions of some presolar silicates in the rims due to heating, either as the result of dust accretion onto relatively hot chondrules [4] or due to low intensity impacts on the meteorite parent body [5].

Elemental compositions also provide constraints. Most presolar silicates have ferromagnesian compositions, with high Fe contents. While some grains show evidence for Fe influx during parent body metamorphism [2], most Fe appears to have condensed into the grains during their formation [6]. Fe isotopic compositions, thus, provide constraints on stellar nucleosynthesis. Measurements on presolar silicates [7] shows that, while most grains have $^{54}Fe/^{56}Fe$ and $^{57}Fe/^{56}Fe$ ratios consistent with AGB model predictions, a few grains show depletions in ^{57}Fe that are not predicted by current AGB models. Similar deficits seen in some mainstream SiC grains [8] are also not well understood.

[1] Zinner (2013) In *Treatise on Geochemistry,* Vol **1.4**, 181. [2] Floss & Stadermann (2012) *MAPS* **47**, 992. [3] Hanecour et al. (2014) *LPS XLV*, #**1316**. [4] Metzler et al. (1992) *GCA* **56**, 2873. [5] Bland *et al* (2012) *LPS XLIII*, #**2005**. [6] Bose et al. (2011) *MAPS* **46**, A26. [7] Ong *et al* (2013) *LPS XLIV*, #**1163**. [8] Marhas *et al* (2008) *ApJ* **689**, 622.