**Zr ISOTOPE SYSTEMATICS OF ALLENDE CAIs.**

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**Introduction:** Calcium-Aluminum-rich Inclusions (CAIs) are isotopically distinct from the rest of the Solar System for a large number of elements (e.g. [1] and references therein). This difference in isotopic character has been attributed largely to incomplete homogenization of nucleosynthetic anomalies in the nebular reservoir sampled by CAIs. Zirconium has five stable isotopes, four of which ($^{90,91,92,94}$Zr) are predominantly formed in stellar environments characterized by low neutron density (*s*-process). Formation of $^{96}$Zr requires higher neutron density environments (*r*-process) which are typically seen in supernovae [2]. Additionally, the decay of the short-lived isotope $^{92}$Nb ($t_{1/2}$ = 35 Ma) to $^{92}$Zr has been previously demonstrated to cause isotopic variation in later formed samples such as ordinary chondrites and mesosiderites [3], although no resolvable $^{92}$Zr excesses in CAIs have been reported [4, 5]. This work investigates the Zr isotopic composition in a suite of CAIs in an attempt to identify the stellar source(s) that contributed to the early Solar System.

**Materials and Methods:** Eight CAIs from the Allende CV3 chondrite that were previously investigated for a wide range of elements [6, 7], as well as multiple terrestrial rock standards, were chemically processed to separate Zr from the rest of the matrix using protocols adapted from those described in [8]. Zirconium isotopes were measured on the Neptune MC-ICPMS at ASU. Samples and standards were analyzed at a concentration of 400 ppb Zr and data were internally normalized to $^{94}$Zr/$^{90}$Zr = 0.33381 [9]. The external reproducibilities of $\varepsilon^{91}$Zr, $\varepsilon^{92}$Zr and $\varepsilon^{96}$Zr are ±0.13, ±0.11, and ±0.22 (2SD), respectively.

**Resuts and Discussions:** The data for all eight CAIs are within uncertainty of the measured terrestrial composition for $\varepsilon^{91}$Zr and $\varepsilon^{92}$Zr, and, therefore, do not show any evidence for excess $^{92}$Zr from the decay of the short-lived $^{92}$Nb. However, each of the analyzed CAIs shows an excess in $\varepsilon^{96}$Zr that is identical within the analytical errors. Our CAIs data thus far yield an average value for $\varepsilon^{96}$Zr of 2.03±0.22 (2SD). Although there is some variation in the previously published Zr isotope compositions of CAIs, the average $\varepsilon^{96}$Zr value reported here is consistent with most previously reported values [4, 5]. Our results suggest that the CAI-forming region was homogenous with respect to Zr isotopes and enriched in stellar material derived from a neutron-rich environment. The enrichment in the r-process isotope $^{96}$Zr is consistent with a model of systematic *r*-process enrichments and depletions following previous work on the same sample set for the isotopic systems of Sr, Mo, Ba, Nd, Sm, Gd, and Dy [6, 7].

**References:** [1] Meyer B. S. & Zinner E. 2006. MESS II: 69-108 Ed.: Lauretta D. S. & McSween H. Y. Jr (The University of Arizona Press) [2] Arlandini et al. 1999. ApJ 525: 886-900 [3] Schönbächler et al. 2002. Science 295: 1705-1708 [4] Schönbächler et al. 2003. EPSL 216: 467-481 [5] Akram et al. 2013. ApJ 777: 169-181 [6] Brennecka et al., 2013. PNAS 110: 17241-17246 [7] Brennecka et al. (2014) Lunar Planet. Sci. XXXV #2280. [8] Zhang et al. 2011. JAAS 26: 2179-2205 [9] Nomura et al. 1983 Int. J Mass. Spectrom. Ion Phys. 50: 219-227.