OXYGEN ISOTOPIC COMPOSITIONS OF SOLAR, MICROMETER-SIZED CORUNDUM GRAINS IN ACID-RESISTANT RESIDUES FROM ORDINARY AND CARBONACEOUS CHONDRITES. K. Makide, K. Nagashima, A. N. Krot, and G. R. Huss. University of Hawai‘i at Mānoa, Honolulu, HI 96822, USA

Introduction: Corundum (Al_2O_3) is thermodynamically the first condensate from a gas of solar compositions (T_{cond} = 1770 K at P_{tot} = 10^{-3} bar [1]). At lower temperature, corundum reacts with nebular gas to form hibonite (T_{cond} = 1728 K at P_{tot} = 10^{-3} bar), grossite (1698 K), perovskite (1680 K), melilite$_{ss}$ (1580 K), and spinel$_{ss}$ (1488 K) [1]. Corundum-bearing CAIs are very rare, possibly indicating efficient reaction with the cooling solar nebula gas [2–6]. The isolated μm-sized corundum grains in primitive chondrites are more common [7–9] and may represent primordial gas-solid condensates, which could have avoided multistage reprocessing during formation of CAIs (some corundum grains may represent evaporation residues [3]). As a result isotopic study of isolated μm-sized corundum grains can potentially provide important constraints on the initial O-isotope composition of the solar nebula and distribution of ^{26}Al in the protoplanetary disk.

Analytical Techniques: Acid-resistant residues of ordinary and carbonaceous chondrites used in our study are from [10]. The obtained grains, 0.5–5 μm in size, were mounted onto clean gold substrate. Corundum, hibonite, spinel, SiC, and TiO_2 grains were identified using a JEOL JSM-5900LV scanning electron microscope equipped with Thermo Electron energy dispersive spectrometer. The residues are dominated by spinel. Hibonite, SiC, and TiO_2 are rare (~1%). Corundum is extremely rare (< 1%) and ranges in size from 0.5 to 5 μm. O-isotope compositions of individual oxide grains were measured with the UH Cameca ims 1280 ion microprobe.

Results and Discussion: Here we report the preliminary results of oxygen-isotope compositions of μm-sized corundum grains from acid-resistant residues of Semarkona (LL3.0), Bishunpur (LL3.1), Allende (CV3.6) and Orgueil (CI1). Most of corundum grains measured are ^{16}O-enriched (Δ^{17}O = −23±8‰, 2σ), similar to those of spinel and hibonite (Δ^{17}O = −24±7‰). These compositions are consistent with Δ^{17}O values of the mineralogically pristine CAIs from primitive (unmetamorphosed) chondrites (−23.3±1.9‰ [11]) and of the solar wind returned by GENESIS (−26.5±5.6‰ [12]). We infer that ^{16}O-rich corundum grains, like CAIs in primitive chondrites, may have recorded oxygen-isotope composition of the nebular gas and possibly of the Sun. Some of the corundum grains are ^{16}O-depleted (Δ^{17}O = −7 to +8‰); their origin is unclear. They may represent evaporative residues of ^{16}O-depleted dust, condensates from an ^{16}O-depleted gas, or bi-products of secondary alteration. We are currently preparing samples of Allan Hills A77307 (CO3.0), Murray (CM2), and Renazzo (CR2) to measure O-isotope compositions of μm-sized corundum and hibonite grains. The results will be reported at the meeting.

References: [1] Ebel & Grossman (2000) *GCA* 64: 339. [2] Bar-Matthews et al. (1982) *GCA* 46: 31. [3] MacPherson et al. (1984) *JGR* 89: C299. [4] Fahey et al. (1987) *ApJL* 323: L91. [5] Hinton et al. (1988) *GCA* 52: 2573. [6] Simon et al. (2002) *MAPS* 37: 535. [7] Nakamura et al. (2006) *LPS* 37: #1267. [8] Huss et al. (1995) *LPS* 26: 641. [9] Strebel et al. (2000) *LPS* 31: #1585. [10] Huss and Lewis (1995) *GCA* 59: 115. [11] Makide et al. (2009) *GCA* in press. [12] McKeegan et al. *LPS* 40: #2494.