Experimental Petrology in the LHDAC

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Phase equilibrium and trace element partitioning between metal and silicate phases (Dmet/sil) can constrain ancient and modern interaction between planetary cores and mantles. Extension of the PT range beyond the reach of the multi-anvil (MA) presents an opportunity - and a challenge - to access, recover, and analyze experiments in the PT space envisioned for an early terrestrial magma ocean as well as the modern CMB. The laser-heated diamond anvil cell (LHDAC) is the only static technique capable of achieving the desired pressures and temperatures, but LHDAC has not yet been systematically developed as a tool of experimental petrology. Our overarching strategy to develop this capability is to (1) start with systems that are well characterized at lower pressures and compare LHDAC results to MA for overlapping P, T, X and fO2 (2) test for equilibrium at all PT conditions by performing “reversals” (3) test for reproducibility by performing replicates of each experiment (4) monitor phase assemblage and melting using X-ray diffraction (5) characterize products using our full analytical arsenal: electron micro-probe (EMP), nano scanning electron micro-probe (nanoSEM), and nano secondary ion mass spectrometry (nanoSIMS). We present the preliminary results of metal/silicate partitioning experiments from 2200-4000K and from 5-60 GPa in the LHDAC on the well-studied C1 chondrite composition. We chose to look at Ni, Co, and Fe in order to facilitate comparison with other multi-anvil (MA) and LHDAC partitioning data (e.g. Li and Agee, 1996; Chabot et al, 2005; Bouhifd and Jephcoat, 2003; Tschauner et al., 1999). We will present our advances in both experimental and analytical methodology.