In-situ Synchrotron High Pressure Laser Heating Experiments

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In the past decade, the number of known metal pernitrides has increased tremendously and has been expanded to several platinum group metals, e.g. OsN_2, IrN_2 PtN_2 [1,2]. The first crystal structure determinations of metal pernitrides, SrN_2 and BaN_2, were reported in 2001 [3,4]. More recently, the experimental discoveries are often preceded by theoretical predictions, which are becoming increasingly important for guiding experiments. Studies of lanthanide pernitrides are limited to the theoretical prediction [5] and experimental observation of LaN_2 in shock experiments [6]. The lack of studies of lanthanide pernitrides in diamond anvil cells (DACs) are likely due to the complications of the air-sensitivity of both lanthanide elements and their mononitrides. We have recently performed *in-situ* high pressure laser heating experiments using nitrogen as the pressure transmitting medium and reactant. DACs were loaded with elemental lanthanides inside an argon glove box and then transferred to the gas-loading system at the Advanced Photon Source (APS). The DACs were loaded with nitrogen gas to explore synthesis of a number of lanthanide pernitrides. The pressure were increased to different target pressures and laser-heated to synthesized novel lanthanide pernitrides. The experimental studies have been complemented by theoretical calculations to explore the *P*,*T*-phase diagram and the nature of the chemical bonding in lanthanide pernitrides.

References

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