On the formation mechanism of HSE-nuggets in experimental and meteoritic silicate systems.

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Highly siderophile element (HSE) nuggets are observed in different materials. Mostly they occur in quenched run products (relating to metal-silicate segregation [e.g. 1]) and in Ca-Al-rich inclusions (CAIs) from chondritic meteorites [e.g. 2]. Other cosmic material also contain these metallic objects [3, 4]. While the cosmic nuggets – known as refractory metal nuggets (RMNs) – were expected to have condensed from the solar gas, the formation mechanism of synthetic nuggets from run products is still unclear. Based on the synthesis of RMNs and on observations on meteoritic material, the RMNs now are interpreted as having formed by precipitation from a silicate- or CAI-liquid [2, 5]. These cosmic nuggets and their host material represent a reservoir of naturally formed nuggets and therefore help us to understand our nugget bearing experimental run products.

Two formation mechanisms of experimental nuggets are favored so far: nugget formation upon quench [1] and equilibrium nugget formation due to a change in the oxidation state of metals within a silicate liquid [6]. A series of experiments with variations in the quench rate and a fixed duration and vice versa demonstrate a dependence of nugget size and abundance on quench rate. Nuggets do not occur, when quenched extremely fast or too slow, but were detected at specific quench rates. At the conference we will present the results from these systematic experiments designed to synthesize nuggets in synthetic CAIs with the aim to shed light on their formation mechanism. Additionally, a comparison of different cosmic nugget bearing materials with run products from our experiments shows remarkable similarities. Thus, a common formation mechanism of cosmic and experimental nuggets can be assumed.

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