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A containerless aerodynamic levitation device in combination with a movable gas-mixing furnace: applications to constrain the origin of chondrules.

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The usability of aerodynamic levitation technique, has shown great potential for studies of the crystallization conditions and paths of chondrule silicate liquids (e.g. Nagashima et al., 2006). This technique, associated with laser heating, allows the conduction of high temperature experiments in which liquid droplets or solids float on top of a vertical gas stream without any container. However, the use of a laser as heating system presents the disadvantage of large temperature gradients within the levitating liquids and uncertainty in temperature determination.
We are developing a technique that combines an aerodynamic levitation apparatus with a moveable vertical gas-mixing furnace. This setting ensures the advantage of the containerless device (i.e. no chemical interaction with the container or heterogeneous nucleation, Pack et al., 2010), allows a better temperature stability compared to the laser and makes possible the control of oxygen fugacity by flowing variable gas mixtures (i.e. H2/H_2O, CO/CO_2, H2/CO_2), as levitating gas. In order to achieve steep temperature gradients and to minimize vibrations that would destabilize the floating spheres the furnace is mounted on rails allowing its vertical movement and the levitation nozzle is fixed at the base of the frame.
The containerless aerodynamic levitation device in combination with a movable gas-mixing furnace can be applied to better understand chondrules and the process of their formation, re-assessing whether chondrules were chemically open (e.g., Libourel et al., 2006) or closed (Alexander et al., 2008). In particular, we will investigate whether it represents a suitable technique to reproduce: 1) chondrule textures using different compositions and cooling rates; 2) the observed Δ17O disequilibrium of phases in chondrules (e.g. Chaussidon et al., 2008) by means of gas-liquid oxygen exchange experiments; 3) the retention of alkali in chondrules during their formation (e.g. Borisov et al., 2008).
Preliminary results will be discussed

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