

Importance of Sample Rotation Control for Containerless Materials Processing on the Ground and in Microgravity

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Abstract

Sample rotation control capability is a must for a contactless processing facility for scientific as well as technological reasons. Sample rotation is preferable during material processing as it offers better temperature homogeneity and its control helps the sample to maintain a spherical shape, which simplifies the data analysis for density and surface tension measurements. Rotation is also an advantage, due to its spin stabilizing effect, when processing electrostatically levitated materials, in particular those having a tendency to form oxide or nitride layers. These advantages were illustrated in this paper with the measurement of the thermophysical properties of Hf and Si. In addition, rotation contributes to fining (bubble migration) and could eventually be used to produce hollow spheres. Besides the obvious disadvantages of excessive rotation for material processing (e.g. sample deformation, instability, induced sedimentation), even a low rotation rate could induce non-negligible g-forces that could be detrimental if the experiment is carried out in microgravity. Hence, rotation control is important not only for ground-based experiments but also to fully exploit microgravity environment.