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Fabrication, optical and thermal properties of glass and crystalline rare-earth aluminates

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Recently, research on bulk glass and glass-ceramics has attracted the attention due to their low cost optical materials of the future. Alumina based ceramics have wide significant applications because of their refractory nature, high hardness, high strength, transparency in the infra-red region and resistant to chemical attack. Conventionally, rare earth perovskites were prepared by melting process or by sintering techniques because of their refractory nature and recently prepared through several low temperature solution routes. Conventionally, it is difficult to vitrify them without using the network forming agents. In this study, Aero-Dynamic Levitator (ADL) was used to undercool the melt well below the melting temperature. The formation of bulk spherical glass and crystalline RAlO3 (R=rare-earths) phases has been investigated due to their unique features in terms of the solidification process, glass structure and optical properties. RAlO3 sample was levitated by an ADL and completely melted by a CO_2 laser and then cooled by turning off the CO_2 laser and solidified. Among the rare earth aluminum perovskites, La, Nd and Sm aluminum perovskites solidified as glass and Eu to Lu aluminum perovskites solidified as crystalline phases. The NdAlO3 glass phase showed a high refractive index of ~1.89, suggesting that container less levitation is an elegant technique for fabrication of new glass and crystalline ceramics from an undercooled melt.

Biography

Vijaya Kumar has his expertise in "Microgravity materials science and conducting experiments using space environment". His research area includes "Solidification, crystal growth, measurement of thermo-physical properties and conducting experiments using space environment". He worked at Japan Aerospace Exploration Agency (JAXA), Japan and NASA, Tufts University, USA. He has built the container less levitation facility for controlling the atmosphere and also to create a microgravity environment on earth. Using these facilities, he has developed new metastable materials, multiferroic composites, metastable phase diagrams, high refractive index glass and so on.

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