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Progress in the study of rare-earth silicate systems

Vasile Cristian Ciomaga Hatnean,[1,2] Aurel Pui,[1] Arkadiy Simonov,[2] and Monica Ciomaga Hatnean[3,4]

[1] *Faculty of Chemistry, Alexandru Ioan Cuza University of Iasi, 700506 Iasi, Romania*
[2] *Laboratory for Disordered Materials, Department of Materials, ETH Zurich, 8093 Zurich, Switzerland*
[3] *Materials Discovery Laboratory, Department of Materials, ETH Zurich, 8093 Zurich, Switzerland*
[4] *Laboratory for Multiscale Materials eXperiments, Paul Scherrer Institute, 5232 Villigen PSI, Switzerland*

Rare-earth silicates are an interesting class of materials owing their potential for optical (laser diodes, scintillators) and environmental barrier coating (EBC) applications. One of the major difficulties encountered in the synthesis and study of these systems is due to the existence of a relatively large number of chemical phases and polymorphism possible at ambient pressure. Moreover, there is an overlap of the thermodynamic stability ranges of the different polymorphs and/or chemical phases, thus hindering the synthesis of pure phase ceramic materials by conventional solid-state reaction. To overcome these drawbacks and study the intrinsic properties of these systems, one can attempt to prepare these materials in crystal form. We successfully prepared large, high quality, crack-free and pure phase single crystals of R_2SiO_5 (R = Dy, Ho and Er) using a laser-diode-heated floating zone furnace. Here, we present the results of our investigations to optimize the synthesis and crystal growth conditions of R_2SiO_5, and discuss the properties of these materials [1]. The progress in preparing single crystals of these materials is crucial for the study of the intrinsic structural, chemical and physical properties of rare-earth silicate systems which will open the route for improving the properties of these materials for applications.

[1] V.C. Ciomaga Hatnean et al., Crystal Growth of the R2SiO5 Compounds (R = Dy, Ho, and Er) by the Floating Zone Method Using a Laser-Diode-Heated Furnace, Crystals 2023, 13, 1687.