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Micrometric single crystal germanates obtained using a double-spherical mirror furnace

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Micro-crystals of two new compounds $EuMnGe_2O_7$ and $SmMnGe_2O_7$ were grown performing the flux method in a double-spherical mirror furnace. One valuable advantage of this system was that the heating profile could be modified easily adjusting lamp positions and orientation as well. The micrometric crystals were observed and analyzed for chemical composition by scanning electron microscopy and energy dispersive spectroscopy. This furnace is perfectly suitable to grow at low price, low temperature and short time new materials as a single crystal for basic research or to obtain raw material.

1 Introduction

One of the most common problems in solid state chemistry is to dispose with the suitable synthesis method to generate novel materials. The growth of single crystals has been developed over the years to meet needs for basic research and applications. Basic methods have been modified and improved to enhance their applicability to specific materials or classes of materials. In our case we are interested in synthesizing single-crystals of new materials with potential optical, electric or magnetic applications. For this reason, we constructed a double-spherical mirror furnace (DSMF), making a variation of the well know double-ellipsoid mirror furnace (DEMF). Our DSMF in combination with a variation of flux synthesis method reported by Taviot-Guéhe et al. [1-2] are an adequate combination to grow micrometric single crystals of new compounds.

Although the mirror furnaces (MF) have been used for years, the improvement was given when space experiments were allowed. These systems were very popular due to the high-temperature operation, through heating achieved by focusing radiation from a lamp; an extremely high purity can be achieved; it can be used selectable atmospheres and pressures; additionally, viewing screen allows monitoring of crystal growth process. Finally, they are compatible with the spatial, physical requirements and safety restrictions in spacecraft [3-6]. The main application of MF is growth single crystals of high temperature superconductors, dielectric and magnetic materials, pure metals and metallic compounds and different experiments related to microgravity environment (space flight) [7, 8].

2 Furnace operation description

It is a well-known result of optics that light emitted at one focus of an elliptical mirror always ends up at the other focus. So, this design results in a single, localized, high temperature spot at the middle of the cavity.

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