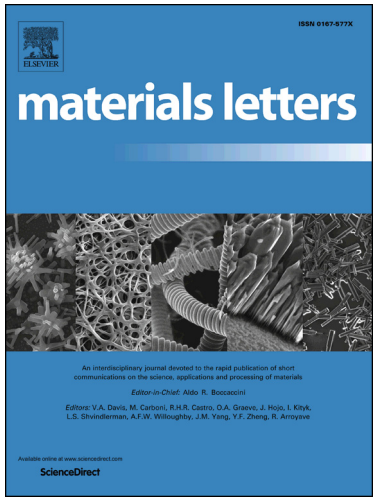

Valence state change of europium in barium aluminates glass ceramics fabricated by containerless processing

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Valence state change of europium in barium aluminates glass ceramics fabricated by containerless processing

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Abstract

Divalent europium ions have been widely used as activators in phosphor materials for many applications, which are commonly obtained from the reduction of trivalent europium raw materials. In this work, barium aluminates are chosen as host materials for studying the change of the Eu valence state in glassy and crystal matrices. Eu-doped barium aluminates glass-ceramics are fabricated by containerless processing and subsequent heat treatment. The structural characteristics are observed and the change of Eu valence state is examined. Possible mechanisms of reduction from Eu^{3+} to Eu^{2+} are discussed.

Keywords: containerless processing, valence state, europium, glass-ceramics

Introduction

It is well known that divalent europium ions (Eu^{2+}) have been widely used as activators in phosphor materials for many applications[1-3]. Since trivalent europium compounds are commonly the raw material more readily available for synthesis of Eu^{2+}-doped materials, the resultant Eu^{2+} ions are usually generated by reduction of Eu^{3+}. The most common method is to calcine the Eu^{3+}-containing materials in a reducing atmosphere[4], and another way is to irradiate the Eu^{3+}-doped sample with high-energy rays[5, 6]. Only a few Eu^{2+}-containing material can be synthesized in oxidizing atmosphere[7]. This is only possible in a few special compounds with rigid three-dimensional enclosed crystal structures and several glass systems[8, 9].

In this work, barium aluminates are chosen as the host materials for studying the Eu valence state change in glassy and crystal matrices. Barium aluminates phosphors, especially $BaAl_2O_4$: Eu phosphors, have been studied for the valence states and spectroscopic properties[7, 10]. Without the traditional