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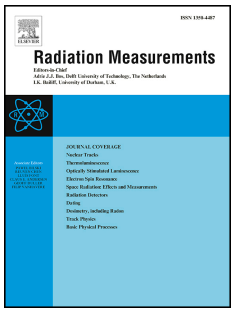

Thermoluminescence kinetics of undoped and doped (Ti, Cu, Ce) lithium aluminate crystals

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Abstract

Lithium aluminate ($LiAlO_2$) crystals, both undoped and doped with Ti, Cu and Ce, were grown using the Micro Pulling Down method and their thermoluminescence (TL) was studied. The first order kinetics of thermoluminescent glow curves was confirmed. The T_{max}-T_{stop} method showed the existence of a high number of overlapping peaks. The same conclusion followed from the deconvolution of TL glow curves. We show that TL signal consists of at least 9 overlapping peaks. Comparison of trap parameters obtained with deconvolution and the variable heating rate method is presented.

1. Introduction

Several works on luminescent properties, of both doped and undoped lithium aluminate ($LiAlO_2$), have been recently presented [1-8]. Most of them are focused on optically stimulated luminescence (OSL). It is attractive for potential use in dosimetry, as it shows quite high sensitivity for ionizing radiation, relatively low effective atomic number (Z_{eff} = 10.7) and content of Li-6, which makes it useful for measurements in neutron fields. Besides OSL, lithium aluminate shows also significant thermoluminescent (TL) signal [9], which however was less thoroughly investigated so far.

The majority of works studied the lithium aluminate crystals grown by the Czochralski method. However, in recent years $LiAlO_2$ crystals were also obtained using the relatively new Micro Pulling Down method [10, 11]. Some other high-sensitive OSL materials, such as lithium magnesium phosphate ($LiMgPO_4$), have also been crystallized recently by this method [12, 13].

In this work we performed the study of TL kinetic properties of undoped and doped (Ti, Cu, Ce) lithium aluminate crystals grown by the Micro Pulling Down technique. Especially calculations of TL kinetic parameters established using T_{max}-T_{stop}, TL glow curve deconvolution and the variable heating rate methods were done. The dependence of number of peaks and its kinetic parameters on the samples dopants is also presented. Moreover the short discussion of applicability of previously mentioned methods used for establish kinetic parameters for lithium aluminate is conducted.

2. Materials and methods