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X-RAY INDUCED DEFECTS IN LITHIUM ORTHOSILICATE AND LITHIUM METATITANATE CERAMICS PREPARED USING SOLID STATE SYNTHESIS METHOD

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Lithium orthosilicate (Li4SiO4) and lithium metatitanate (Li2TiO3) for radiation-induced defect studies have been made using numerous methods including sol-gel, melt-spraying, drip-casting and solid-state reaction process in order to evaluate radiation stability of material for application as tritium breeding ceramics in future thermonuclear fusion reactors [1,2]. Solid-state reaction process has many advantages, such as high yield and easy scalability [3], however, to confirm the radiation stability of the material synthesized using this method, the formation and accumulation of radiation-induced defect must be assessed.
In this study, Li4SiO4, Li4SiO4 with additions of Li2TiO3, Li2TiO3 powder samples obtained by solid-state synthesis route as well as mechanically mixed Li4SiO4 and Li2TiO3 powders were pressed into 10 mm pellets using manual hydraulic press at room temperature in air. Afterwards, the prepared pellets were irradiated with X-rays in high vacuum with pressure less than 10-2 Pa at room temperature using an X-ray tube with wolfram anode. Operating parameters are as follows: 40 kV, 10 mA, irradiation time 15 minutes, and pressed pellet distance from X-ray tube is approx. 15 cm. The total concentration of formed and accumulated X-ray induced defects was assessed using electron paramagnetic resonance (EPR) spectrometry and thermally stimulated luminescence (TSL) technique.
The obtained results show that Li2TiO3 had the lowest concentration of both EPR and TSL active X-ray induced defects. The concentration of TSL active defects in the Li4SiO4 pellets with additions of Li2TiO3 significantly exceeded those detected in Li2TiO3, Li4SiO4 pellets and in mechanically mixed Li4SiO4 and Li2TiO3 samples.
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