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Study of the glass and glass ceramic BaO*2(SiO2):Ce (DSB: Ce) scintillation material for high energy physics application

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The development of new crystalline materials for ionizing radiation detectors is still playing a significant role in applications in high energy physics (HEP). Further concepts of the detectors at HEP experiments will require an unique combination of the material features, particularly in case of collider experiments. A possible candidate can be the so called DSB: Ce glass ceramics obtained from the BaO*2(SiO2). The transparent glass ceramics contains nano-sized particles of Ba2SiO5 which improve the scintillation properties of the resulted material. A systematic study of small volume (not more than 1 cm3) DSB: Ce material has been reported in [1,2]. On the other side, DSB: Ce glass ceramics heavily loaded with Gd can become a candidate for neutron detectors. Crucially important is a minimal level of radiation damage under the electromagnetic part of ionizing radiation and energetic hadrons as well: low deterioration of the optical transmission, low level of afterglow and low level of radio luminescence due to radio-nuclides being generated in nuclear reactions within the material of the detector. This report will focus on the investigations on scintillation properties of first bulk samples with 4 cm thickness made of DSB:Ce as well as DSB:Ce heavily loaded with Gd. We have measured the light yield and the optical transmittance of both DSB types before and after irradiations with 1.2 MeV gamma-quanta and 190 MeV protons, respectively.

1. K.-T. Brinkman, et al., Radiation Damage and Recovery of Medium Heavy and Light Inorganic Crystalline, Glass and Glass Ceramic Materials after Irradiation With 150 MeV Protons and 1.2MeV Gamma-Rays, presented at IEEE NSS 2014, Seattle, WA, USA, 8-15 November 2014.
2. A. Borisevich, et al., Optical transmission radiation damage and recovery stimulation of DSB: Ce3+ inorganic scintillation material, 2015, J. Phys.: Conf. Ser. 587, 012063.

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