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Performance of DSB - a new glass and glass ceramic as scintillation material for future calorimetry

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In the past crystalline inorganic scintillation material has played a dominant role in calorimetry in medium and high energy physics experiments. Future detector developments will have to focus on cheap, fast, and radiation hard materials in particular with respect to damage caused by hadrons. Developments have been directed towards scintillation materials with a lower effective nuclear charge. The present study is focusing on the glass material BaO*2SiO2 (DSB) using different activators such as Ce or Gd ions, respectively. The production of samples in different geometries has optimized the sintering processes using the established technology of glass production. We will report on the achieved performance of various DSB samples up to large blocks of 20x20x120mm3 or thin fibers with respect to the light output, scintillation kinetics, optical transmission and homogeneity and radiation hardness after irradiation with high doses of gamma-rays or 150 MeV protons. For the first time, a 3x3 matrix read out with photomultiplier tubes has been used to measure the response to energy marked photons between 20 MeV and 380 MeV provided by the A2-tagging facility of MAMI at Mainz. The paper will discuss the achieved energy resolutions compared to GEANT4 simulations.

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Secondary topics

Applications

Design concepts for future calorimeter at the intensity frontier

Primary topic

Novel Materials

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