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Li-Be-Si-Ce scintillation glass and glass ceramics with moderate properties

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A family of lithium silicate glasses and glass ceramics doped with Ce ions show high light yield under thermal neutrons [1]. There are several lithium containing scintillation glasses available on the market. The most widely applied scintillation glass is GS-20 type glass, which has a complex Si-Al-Li-Mg-Ce composition. This composition is hardly used to obtain glass ceramics, which has obvious advantages over an amorphous glass [2]. Glass ceramics combines the luminescent properties of rare-earth ions in crystallites and remaining mother glass. Efficiency of the neutron detection with lithium silicate glass is defined by 6Li neutron cross-section and its content in the glass. Due to this reason scintillation glass is an attractive material to detect thermal neutrons. Effective detection of epithermal and fast neutrons with 6Li glass requires application of a moderator, enriched with such nuclei as carbon, beryllium etc.
Here we report on scintillation properties of the light scintillation glass combining Li and Be ions. Be neutron cross-section predominantly is formed by scattering and is one of the largest among light nuclei, so epithermal and fast neutrons are effectively slowed down in such glass, which increases an efficiency of their capturing by neighbor 6Li nuclei. Li-Be-Si glass containing 20 mol.% of Li2O and BeO was prepared according to the technological approach described in [2].
In the present work, the photo- and radio-luminescence properties of the Li-Be-Si glass, activated by Ce ions, and with different Li/Be ratio were studied. The best achieved light yield at maximal Be content in the glass was measured to be 5000 photons/neutron. Results of the simulation of the neutron detection with the developed glass in a wide energy range are also discussed.

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2. P.Lecoq, A.Gektin, M.Korzhik, Inorganic Scintillators for Detector Systems, Springer, 2017, P.408

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