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#11-100 Measurement and simulation of the new liquid organic scintillator response to fast neutrons

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Liquid organic scintillators are important devices for measurements of neutron radiation. This work aims to develop and optimize the composition of liquid organic scintillators so it can be used for fast neutron spectrometry. As the neutron radiation is usually accompanied with γ ray radiation, it is important to have quality γ/n discrimination. The new cocktail for house made liquid organic scintillator is prepared and studied with intention of being able to separate gamma and neutron for neutron energies above 0.5 MeV while keeping lower constraints on practical use (e.g. sealing because of oxygen) than commercial liquid scintillators. In preceding work the composition of liquid scintillators was optimized. Two two-component scintillators were selected for further studies. Solvent DIPN (Di –iso –propyl - naphthalene Mixed Isomers) is selected for both. First is mixed with uminophore PYR (1 –Phenyl -3 -(2,4,6 –trimethyl –phenyl) -2 –pyrazoline) of concentration 5 g/l. Second is mixed with luminophore THIO (2,5 –Bis (5 –tert –butyl –benzoxazol –2 –yl) thiophene) of concentration 5 g/l.

In this work the response of scintillator to monoenergetic beam of neutrons was measured for multiple neutron energies at PTB in Braunschweig. The two parameter spectrometric system NGA-01 is used to analyze the energy and discrimination characteristics. 137 Cs and 60 Co are used as radiation sources for calibration with pure γ rays. Then the response of scintillator for same neutron energies was simulated using GEANT4. The dissipated energy in the scintillator in response to monoenergetic neutrons is obtained. Both, measured and simulated responses are compared. Functional dependence for yield of recoiled products is estimated. It is seen that main recoil product hydrogen proton is well observed in both. From the edge of proton response one can assume the yield for given neutron energy. The recoiled carbon ion (from elastic collision) is on the other side difficult to observe in measured results but clearly seen in dissipated energy plots. It suggests that yield of carbon ion is very small relatively to proton yield. These results will serve as basis for response function evaluation of scintillator which is necessary for evaluation of unknown neutron spectra from measurements with scintillator.

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