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ACTIVATED LITHIUM FLUORIDE – INORGANIC SCINTILLATOR FOR DETECTING NEUTRINO

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Development of neutrino astrophysics has increased an interest to scintillators on the basis of lithium fluoride because of high interaction cross section solar neutrino with nuclei ^{7}Li and ^{19}F. Although interest to such scintillators existed long ago (lithium-containing phosphors effectively captures thermal neutrons and tissue dose-equivalent property of LiF makes it an object of scintillation dosimetry) before the works carry out in the Institute for Single Crystals, National Academy of Science of Ukraine, scintillators on the basis of LiF single crystals, applicable to solar neutrino detection did not exist. Scintillation lithium fluoride has been obtained owing to successful completion of investigations directed for non-traditional activator search. Three scintillation materials have been obtained: LiF(Ti), LiF(Nb) and LiF(W). Emission center in these crystals is polyatomic quasi-molecule consisted of polyvalent impurity cation, oxygen ions and charge-compensating vacancies.

The developed scintillators have the following characteristics:

- wavelength of maximum emission falls on the region of 370 nm for LiF(Nb), 410 nm for LiF(Ti) and 430 nm for LiF(W);
- absorption coefficient at wavelength of maximum emission does not exceed 0.01 cm^{-1};
- decay constant for LiF(Nb) and LiF(W) is 40 μs, for LiF(Ti) -100ms (there is also a short component in scintillation pulse with decay time less one microsecond, the share of which is no more than 10 % in total emission);
- scintillation conversion efficiency is no less than 2 % regarding NaI(Tl);
- energy resolution of the detector with 150×150 mm section and up to 400 mm length at beta excitation (E_e = 10 MeV) does not exceed 15%.

New scintillators can be successfully used for thermal neutrons, alpha and beta particles detection on gamma radiation background.