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Nanoscintillators based on the emission of self-trapped excitons in layered PbI_2 nanoclusters YURIY GNATENKO, ANATOLI BUKIVSKII, YURIY PIRYATINSKI, Institute of Physics of National Academy of Sciences — We studied the dynamics of excitons excited in layered semiconductor PbI_2 nanoclusters (NCLs), embedded in CdI_2 crystal matrix, using time-resolved photoluminescence (TRPL) spectroscopy. TRPL spectra reveal formation of self-trapped excitons (STEs) in nanosecond scale. The effective energy transfer from the small to the larger semiconductor NCLs, which arises from dipole-dipole intercluster interactions, takes place in sub-nanosecond scale. We demonstrate that the STEs are stable states and they define effective photoluminescence and radioluminescence of the investigated $Pb_{1-X}Cd_XI_2$ alloys. Thus, the $Pb_{1-X}Cd_XI_2$ alloys can be considered as new scintillator materials, where the radioluminescence is determined by the emission of STEs in the layered semiconductor NCLs, and can be named bulk-nanostructured scintillators (or nanoscintillators). It should be noted that these nanoscintilators are strongly radiation-resistant. Our results may pave the way towards a new class of effective scintillator materials based on the emission of the STEs in the semiconductor NCLs. The further increase of the emission intensity of such nanoscintillator materials is possible by optimizing the size distribution of NCLs in the $Pb_{1-X}Cd_XI_2$ alloys and by means of thermoelectric cooling.

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