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Radiative Recombination of Bound Excitons in $MoSe_2$:I_2 Layered Crystals

M. Siminel[1], V. Nedelea[1,2], K. Sushkevich[1,2], A. Siminel[1], A. Micu[1], and L. Kulyuk[1]
[1]*Institute of Applied Physics, Academiei str. 5, Chisinau MD-2028, Republic of Moldova*
[2]*Moldova State University, Mateevici str. 60, Chisinau MD-2009, Republic of Moldova*

The steady-state and time-resolved photoluminescence (PL) of excitons bound on intercalated iodine molecules was studied for the first time in $MoSe_2$:I_2 layered single crystals. Along with narrow exciton spectral lines located near the energy of the $MoSe_2$ indirect bandgap in the region of 0.98-1.06 eV, an IR broadband radiation centered at 0.78 eV and caused by the recombination of photoexcited carriers through the intrinsic lattice defects were found. To describe the temperature dependences of the intensity of steady-state PL, as well as its temporal characteristics, a kinetic model was proposed that takes into account the radiative and non-radiative recombination channels present in this quasi-two-dimensional semiconductor.