Optical and magnetic effects in Mn isolated impurities in CdTe and GaAs

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Manganese ions are commonly used magnetic dopants for crystal compounds consisting of II and VI periodic groups atoms as well as crystals grown using III and V periodic groups nuclei. These ions impurities play crusial role in magnetic, optical and transport properties of such crystals, but they are different from one crystal to another. Mn ion substitutes Cd atom in CdTe crystal and forms an isovalent center with half-filled inner d-shell. After Light illumimation an intracentral d-d transitions can arose leading to excited state $^4T_1$ with both spinal and orbital degeneration. The latter results in strong Jahn-Teller coupling with local vibrations of e-type symmetry. The Jahn-Teller coupling leads to a coexistence of both linear-linear and circular-circular polarization response of the luminescence process. Manganese ion can also form an acceptor center as it is the case of Mn in GaAs, which substitutes Ga atom and bounds a hole in Γ_8 symmetry Bloch state from the valence band. Such acceptor center energy spectrum is sensitive to the local distortions that could affect magnetic properties of the center via strong exchange coupling between the hole and the half-filled inner d-shell. This influence manifests itself in close-to-the-room temperature dependence of magnetic susceptibility.

These two examples highlight the role of local distortions in magnetic center in semiconductors. The researches were done with the suport of RSF (projects 18-72-0018-72-00115 and 18-72-10111) and BASIS foundation.