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Visible-light electroluminescence in Mn-doped GaAs light-emitting diodes DAIKI MARUO, Department of Electrical Engineering and Information Systems, University of Tokyo, PHAM NAM HAI, Department of Physical Electronics, Tokyo Institute of Technology, MASAAKI TANAKA, Department of Electrical Engineering and Information Systems, University of Tokyo — We demonstrate visible-light electroluminescence (EL) due to *d*-*d* transitions in GaAs:Mn based LEDs. We design p^+-n junctions with a p^+ GaAs:Mn layer, in which at a reverse bias voltage (-3 to -6 V), an intense electric field builds up in the depletion layers of the p^+-n junctions. Holes are injected to the depletion layer by Zener tunneling from the conduction band or by diffusion of minority holes from the valence band of the n-type layer. These holes are accelerated by the intense electric field in the depletion layer, and excite the *d* electrons of Mn in the p^+ GaAs:Mn layer by impact excitations. We observe visible-light emission at $E_1 = 1.89$ eV and $E_2 = 2.16$ eV, which are exactly the same as the ${}^4T_1 \rightarrow {}^6A_1$ and ${}^4A_2 \rightarrow {}^4T_1$ transition energy of Mn. The threshold voltage for observation of visible-light EL is -4 V, corresponding to $-(E_1 + E_2)/e$. This indicates that the impact excitation is most effective for the one step excitation from the ground state ${}^6A_1$ to the highest excited state ${}^4A_2$.

Masaaki Tanaka
University of Tokyo

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