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Optical and Magnetic Resonance Studies of Na-Diffused ZnO Bulk Single Crystals E.R. GLASER, N.Y. GARCES, Naval Research Laboratory, N.S. PARMAR, K.G. LYNN, Washington State U. — Photoluminescence (PL) and optically-detected magnetic resonance (ODMR) at 24 GHz were performed on bulk ZnO crystals after diffusion of Na impurities that were explored as an alternate doping source for p-type conductivity. PL at 2K revealed strong bandedge excitonic recombination at 3.361 eV and a broad "orange" PL band at 2.17 eV with FWHM of ∼0.5 eV. This "orange" emission is very similar to that reported previously[1] from thermoluminescence measurements of intentionally Na-doped bulk ZnO and, thus, strongly suggests the incorporation and activation of the Na-diffused impurities. ODMR performed on this "orange" PL revealed two signals. The first was a sharp feature with g-value of ∼1.96 and is a well-known "fingerprint" of shallow donors in ZnO. The second signal consisted of a pair of lines with an intensity ratio of ∼3:1 and with g-tensors ($g_{\parallel}$,$g_{\perp}$∼2.008-2.029) very similar to ESR signals attributed previously[2] to holes bound to Na impurities located at the axial and non-axial Zn host lattice sites in Na-doped ZnO. Thus, the "orange" PL can be tentatively assigned to radiative recombination between residual shallow donors and deep Na-related hole traps.

[1]D. Zwingel and F. Gartner, Solid State Commun. 14, 45 (1974).
[2]Ibid.

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