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Origin of the "Red" Luminescence Band in Bulk N-doped ZnO
E.R. GLASER, N.Y. GARCES, Naval Research Laboratory, M.C. TARUN, M.D. MCCLUSKEY, Washington State U. — Optically detected magnetic resonance (ODMR) at 24 GHz was performed on bulk ZnO crystals doped with nitrogen impurities (of high interest for p-type conductivity) to provide more details on the origin of a recently reported red/near-IR photoluminescence (PL) band.[1] PL at 7K revealed strong bandedge excitonic recombination at 3.364 eV, a broad "green" emission band at 2.45 eV, and a broad "red" PL band near 1.7 eV. Two luminescence-increasing ODMR signals were found on this "red" emission. The first was a sharp feature with g-value of 1.957 and FWHM of 1 mT and is attributed to shallow donors based on electron spin resonance (ESR) of n-type ZnO. The second feature exhibited a g-value near 2 and a broad, asymmetric lineshape with FWHM of $\sim$ 10 mT. A simulation of the spectrum showed that the broad resonance could be fit as the sum of three equally spaced lines with magnetic field splitting value and relative intensities in close agreement to those observed for deep nitrogen acceptors as identified from previous ESR studies. Thus, the ODMR results strongly suggest that the "red" PL is due to radiative recombination involving residual shallow donors and deep nitrogen acceptor centers.

[1]M.C. Tarun et al., AIP Advances **1**, 022105 (2011).

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