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Photoluminescence and ferromagnetism in nitrogen doped ZnO nanoclusters YUFENG TIAN[1], RYAN SOUZA, ALAN MCCONNAUGHEY, AMIT SHARMA, Department of Physics, University of Idaho, USA, SHISHEN YAN, Department of Physics, Shandong University, P. R. China, YOU QIANG, Department of Physics, University of Idaho, USA — Wide-band-gap semiconductor ZnO has been extensively studied for its potential applications in optoelectronic and spintronics. Nitrogen is supposed to be the most promising p-type dopant. We synthesized nitrogen doped ZnO nanoclusters using a third generation sputtering-gas-aggregation cluster source. High-resolution TEM images show nanoclusters sizes are around 12 nm. XRD patterns are identical to bulk ZnO wurtzite structure with the existence of Zn as a minor phase. PL measurements reveal both ultraviolet and green emission which is respectively attributed to recombination of free excitons and deep defect level emissions from intrinsic defects. Unexpected room temperature ferromagnetism is obtained without any magnetic doping elements. It is believed when the doping nitrogen atom is beside zinc atom, one electron in the completely filled d-orbits of Zn possibly jumps to compensate the dangling bond of nitrogen in order to reduce energy. Net spin is established in the left d-orbits of zinc and long range ferromagnetism can be established as described by a bound magnetic polaron model.
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