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FTIR characterization of Co-doped ZnO microwires grown by optical furnace method

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Transition-metal doped wurtzite ZnO is well known and intensively investigated wide-gap diluted magnetic semiconductor promising for application in spintronic devices. The effect of Co doping on structural and optical properties of ZnO microwires were investigated using scanning electron microscopy (SEM), electron diffraction spectroscopy (EDS), photoluminescence (PL) and optical absorption spectroscopy characterization techniques. SEM microscopy showed that Co-doped MWs has hexagonal facets and cavity inside, thus forming a micrometer-sized tube-like structures with lengths of 1.2 mm and diameter of 50-10 µm. The average local Co concentration in ZnO:Co microwire determined by the EDS technique was found as 1.5 atomic percent %.

Optical absorption spectroscopy was carried out to study the influence of Co doping on electron energy scheme of ZnO microwire. A series of intense absorption bands in the region of 3800 – 4500 cm^{-1} ($^4T_2(^4F)$ transition) and 5500 – 9000 cm^{-1} ($^4T_1(^4F)$ transition) were registered in the spectrum of ZnO:Co microwire while no features in this spectral range were registered for pure ZnO microwire. The observation of intensive absorption bands upon Co-doping clearly reveals that the cobalt atoms substitutes Zn^{2+} cations in the hexagonal ZnO matrix and are present in Co^{2+} state. Variation in related intensity of these absorption peaks along the whole length of the individual MW indicate non-uniform spatial distribution of Co, which is in agreement with EDS data and previous electron paramagnetic study. This work was supported by NATO Grant SfP 984735.