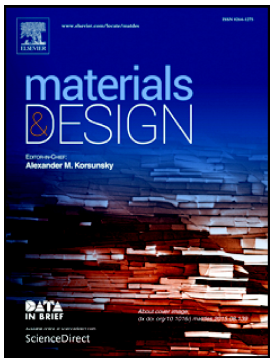

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Tuned magnetic properties of Co-doped ZnO/B-doped Graphene PN junction

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Abstract

Co-doped ZnO($Zn_{1-x}Co_xO$)/B-doped graphene(BG) PN junction with quasi-core-shell nanostructure is designed and fabricated by a facile chemical process. The interplay between the $Zn_{1-x}Co_xO$ core and the BG shell is discussed. X-ray Photoelectron Spectroscopy (XPS) and photoluminescence (PL) spectra confirm that B and Co^{2+} ions are doped successfully. The C1s XPS spectra suggest the formation of the Zn(Co)-O-C=O bonds, which can efficiently transfer the holes from BG to $Zn_{1-x}Co_xO$. X-ray diffraction (XRD) displays that Co doping hardly changes the wurtzite structure of ZnO. It can be clearly seen that edge of the BG covers $Zn_{1-x}Co_xO$ to form the quasi-core-shell structure by High-resolution transmission electron microscopy (HRTEM). The position of the G band in Raman spectrum indicates that BG is P-type. The interaction between the $Zn_{1-x}Co_xO$ and BG can be found by the red-shifts of E_{2H} band of $Zn_{1-x}Co_xO$ and broader 2D of BG as well. Magnetization measurement demonstrates that the increasing of the ferromagnetic phases in $Zn_{1-x}Co_xO$/BG nanoparticles with the increasing temperature. The observed ferromagnetic phases can be due to the exchange of the electron/hole at interface in the $Zn_{1-x}Co_xO$/BG PN junction.

Key words: Core-shell nanostructures; PN junction; Diluted magnetic semiconductor

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