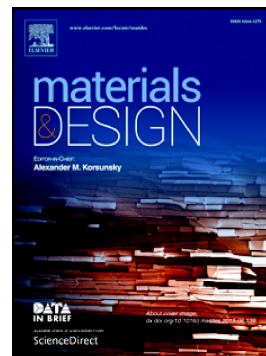


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Tuned magnetic properties of Co-doped ZnO/B-doped Graphene PN junction

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Abstract

Co-doped ZnO($\text{Zn}_{1-x}\text{Co}_x\text{O}$)/B-doped graphene(BG) PN junction with quasi-core-shell nanostructure is designed and fabricated by a facile chemical process. The interplay between the $\text{Zn}_{1-x}\text{Co}_x\text{O}$ 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 $\text{Zn}(\text{Co})\text{-O-C=O}$ bonds, which can efficiently transfer the holes from BG to $\text{Zn}_{1-x}\text{Co}_x\text{O}$. 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 $\text{Zn}_{1-x}\text{Co}_x\text{O}$ 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 $\text{Zn}_{1-x}\text{Co}_x\text{O}$ and BG can be found by the red-shifts of $\text{E}_{2\text{H}}$ band of $\text{Zn}_{1-x}\text{Co}_x\text{O}$ and broader 2D of BG as well. Magnetization measurement demonstrates that the increasing of the ferromagnetic phases in $\text{Zn}_{1-x}\text{Co}_x\text{O}/\text{BG}$ nanoparticles with the increasing temperature. The observed ferromagnetic phases can be due to the exchange of the electron/hole at interface in the $\text{Zn}_{1-x}\text{Co}_x\text{O}/\text{BG}$ PN junction.

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

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