Investigation of the optoelectronic properties of hybrid heterojunction.

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To exploit potential of 1D ZnO nanostructures fully [1], one of the essential problems which must be solved is the preparation of a rectifying junction. Even though papers on p-type conductivity in ZnO are not scarce [2], they have not been followed up by reports of reproducible p–n junctions and by their use in real devices. An alternative way to create rectifying junctions is to use other p-type materials, either inorganic or organic to form heterojunction with n-type ZnO [3]. Among different p-type materials, copper halides with a direct wide bandgap, large exciton binding energy, high mobility, and high transparency in the visible range is considered to be the most promising one [4]. In addition, the possibility of preparation core-shell heterojunctions based on ZnO and copper halides can offer superior properties, they particularly can enhance the light absorption, increase the surface area, reduce the carrier recombination, and improve the charge collection efficiency.

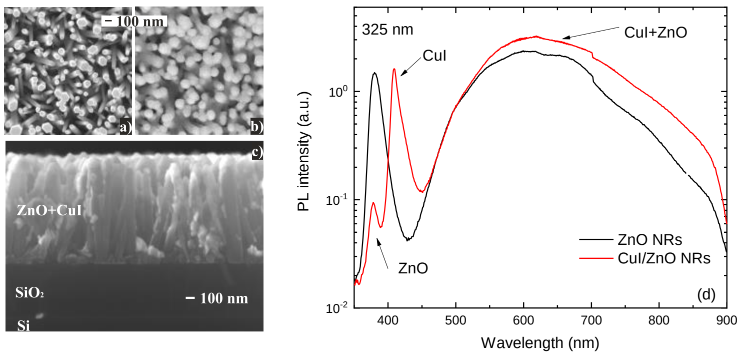

Fig. 1 Top-view and cross-sectional SEM images of: (a) bare ZnO NRs, (b) ZnO NRs covered by CuI film, (c) core-shell heterojunction between n-type ZnO and p-type CuI; (d) RT PL spectra for bare ZnO NRs (black), for the CuI film deposited on ZnO NRs (red).

In this work, the core-shell heterojunctions were formed between n-type ZnO nanorods and p-type CuI; vertically-oriented ZnO nanorod arrays were grown on seed layers by the chemical bath deposition method [1] and then CuI [5] was deposited on top of ZnO nanorod by pulsed laser deposition at room temperature. Current-voltage measurements, capacitance-voltage frequency measurements, and impedance spectroscopy were applied to investigate the CuI/ZnO interface and to extract their electrical parameters. Moreover, the optical properties of hybrid heterojunction was investigated using photoluminescence spectroscopy.

References
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