Fabrication of hybrid $CuO/Cu_2O/ZnO$ nanostructures with direct p-n junctions

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Nowadays, the important task is to reduce the negative influence of industrial and domestic processes on the environment and climate change. This may be done by the replacement of the toxic components to the environmentally friendly ones where possible. Zinc and copper oxides (ZnO, CuO, Cu_2O) are perspective materials for the fabrication of modern, environmentally-friendly electronic devices due to their low cost, non-toxicity, and excellent photovoltaic, photosensitive, thermoelectric, etc. properties.

The presence of p-n junction has a vital role in many electronic devices (for example, solar cells and LEDs). Thus, the fabrication and investigation of new hybrid metal oxide nanostructures is an important task.

Current study is dedicated to the fabrication of new hybrid metal oxide nanomaterials based on $CuO/Cu_2O/ZnO$ nanostructures with multiple p-n junctions. The CuO nanostructures were synthesized using the thermal oxidation method from copper foil, followed by annealing in an inert atmosphere to CuO/Cu_2O structures using the previously developed method [1]. ZnO nanolayers of different thicknesses were deposited on top of CuO/Cu_2O nanostructures by physical vapor deposition of Zn followed by thermal oxidation [2]. The SEM-EDX was used for the characterization of morphology and the ratio of the p-type and n-type components in fabricated hybrid structures. The p-n junctions of fabricated hybrid metal oxide nanomaterials were characterized by measuring I-V curves *through-plane* between the copper substrate and ZnO top layer. The obtained I-V curves showed that the ZnO layer thickness and ratio of the p- and n-type components strongly impact the direct p-n junction behavior in $CuO/Cu_2O/ZnO$ nanostructures. Obtained results can be useful for further developing direct p-n junction-based electronic devices.

References

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