Synthesis and characterization of 1D ZnO NPs modified with gold

Section: Nanocomposites and nanomaterials

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INTRODUCTION

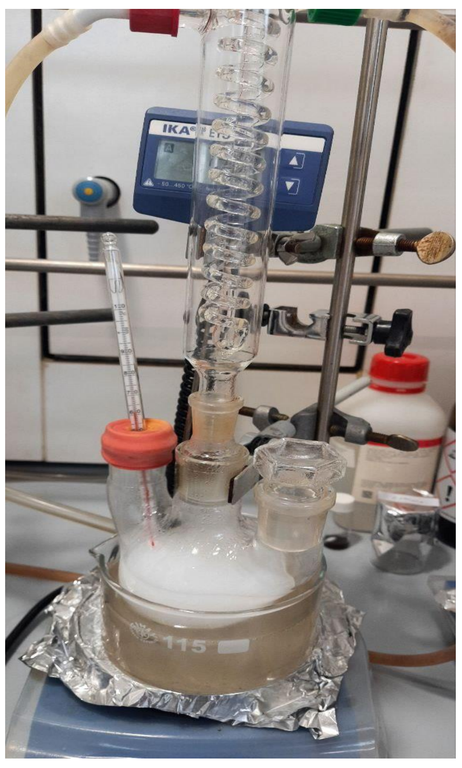

Fig. 2. Synthesis of ZnO nanorods

ZnO NPs with controlled morphology due to their non-toxicity, high photosensitivity, high surface-to-volume ratio, efficient charge transport, and chemical stability can find application in different scientific fields. Among different morphologies, the one-dimensional nanostructures provide a direct and stable pathway for rapid electron transport. The attachment of Au NPs to semiconductor ZnO nanorods or nanowires is a powerful approach for producing new chemically functionalized materials with improved photoelectrochemical activity. Au NPs are relatively stable, catalytically active, water-soluble, optically sensitive, and biocompatible.

AIM

In this work, we provided facile methods to synthesize ZnO-Au nanohybrids. Several types of 1D ZnO nanomaterials (NWs) and nanorods (NRs) were used.

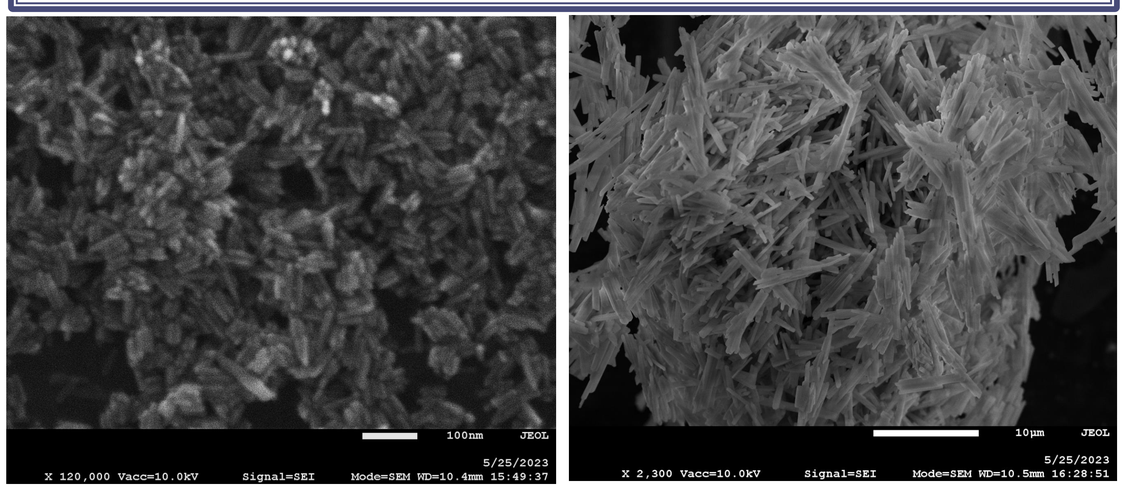

Fig. 1. SEM images of a) ZnO NRs b) ZnO NWs

MATERIALS AND METHODS

ZnO NRs were obtained by the sol-gel method. The Au NPs were deposited from $HAuCl_4$ solutions directly onto ZnO NWs and ZnO NRs without adding any linking molecules. The structure, crystallinity, and morphology of ZnO and ZnO/Au nanomaterials have been investigated with XRD, SEM, TEM, RAMAN, and FTIR spectroscopy.

Fig. 4. Synthesis of Au NPs on ZnO by photo-deposition

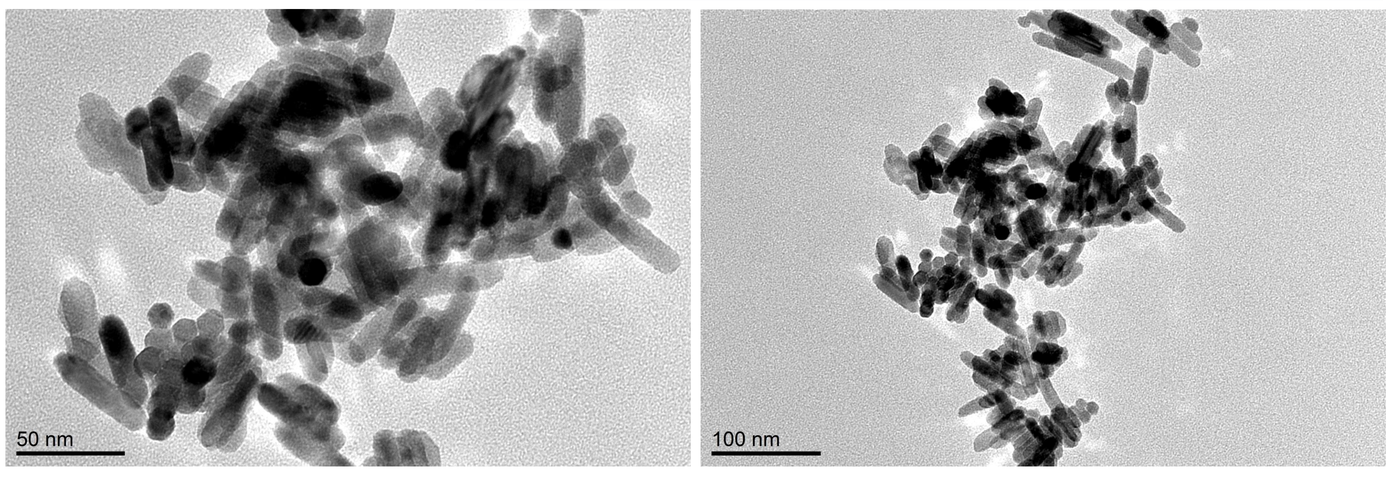

Fig. 3. TEM image of ZnO NRs loaded with Au NPs by photo-deposition

RESULTS

The Au NPs density and size of on ZnO NRs and NWs can be controlled by adjusting the concentration of $HAuCl_4$. Several types of ZnO-Au nanohybrid were produced at room temperature, by varying type of ZnO nanostructures, namely the Au NPs were photo-deposited from pre-irradiated $HAuCl_4$–ethanol solution directly onto ZnO nanostructures dissolved in toluene solution. It is possible when light (UV diode 370 ± 10 nm, power 64 mW, intensity 35 mW/cm^2, continuous irradiation) is absorbed by the semiconductor to generate high energy electrons and reduce a $HAuCl_4$ salt at the ZnO interface.

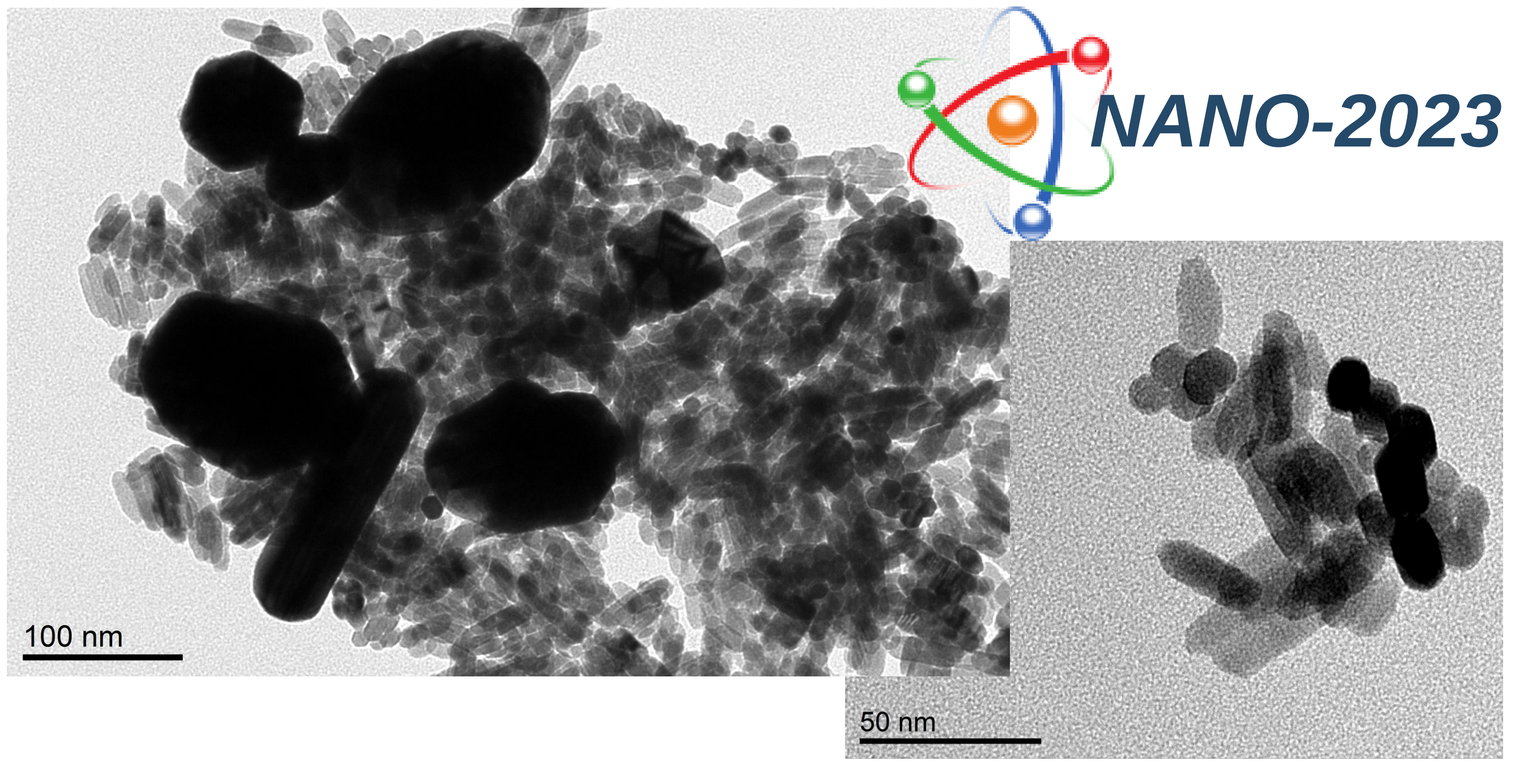

Fig. 5. TEM image of ZnO NWs loaded with Au NPs by photo-deposition

CONCLUSIONS

Obtained results will allow to use ZnO 1D nanostructures as a potential platform for creation of electrochemical biosensors and photocatalysts. It is concluded that the optimal time of photo-deposition will be 20 min.

ACKNOWLEDGEMENT

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