Investigation on the effects of Oxygen and Hydrogen plasma atmospheres on antimicrobial properties of ZnO nanowires

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1-Introduction

The main purpose of this project is to lower the cytotoxicity level of ZnO nanowires using Oxygen and Hydrogen plasma atmospheres. Plasma treatment can induce reactive Oxygen and Zinc ions under the effect of a powerful electric field; therefore, biocompatible ZnO nanowires can be achieved and prepared for biomedical applications.

Zinc Oxide (ZnO) nanostructures are one of the most applicable semiconductors that are widely used in various industries such as chemical industries and sensors such as gas sensors, UV and PH detectors, chemical sensors, and biosensors.

There are numerous methods for synthesizing ZnO nanowires such as chemical vapor deposition (CVD), physical vapor deposition (PVD), sputtering, sol gel, wet chemical, and electro spinning which simplify provision of them.

ZnO nanowires are biocompatible in normal concentrations, however, recent researches have shown a noteworthy level of cytotoxicity in high concentrations. As studies have shown, cytotoxicity of ZnO nanowires is attributed to Oxygen vacancies.

2- Experiment

ZnO nanowires are synthesized by a wet chemical method. Zinc acetate dehydrate $[Zn(CH_3COOH)_22H_2O]$ and PVP are used in the experiments as precursor and capping and methanol is used as solvent. Subsequently the synthesized nanowires are exposed to Oxygen and Hydrogen plasma atmospheres to reduce the amount of Oxygen vacancies.

3- Conclusion

ZnO nanowires can be used in biomedical fields; however, cytotoxicity of them, which is attributed to existence of Oxygen vacancies, might limit their applications as biosensors. In this project plasma treatment is used for reducing the cytotoxicity of nanowires by reducing the amount of Oxygen vacancies. There has been studies on reducing the Oxygen vacancies by heat treatment. Our study shows the cytotoxicity of the nanowires can be reduced by removing the Oxygen vacancies in near room temperatures by exposing the nanowires to Hydrogen and Oxygen plasma atmospheres. However, better results can be achieved using Oxygen plasma to remove Oxygen vacancies.

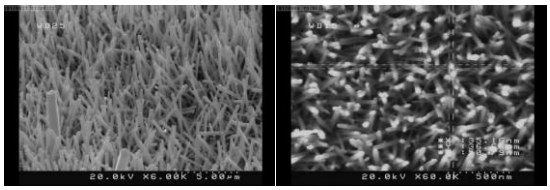

Fig. 1 – SEM images showing the synthesized ZnO nanowires. The average nanowire diameter is 50nm.

References

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