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Effect of deposition parameters on structure of ZnO films deposited by an DC Arc Plasmatron

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Zinc oxide based thin films have been extensively studied in recent several years because they have very interesting properties and zinc oxide is non-poisonous, abundant and cheap material. ZnO films are employed in different applications like transparent conductive layers in solar cells, protective coatings and so on. Wide industrial application of the ZnO films requires of development of cheap, effective and scalable technology. Typically used technologies don't completely satisfy the industrial requirements.

In the present work, we studied effect of the deposition parameters on the structure and properties of ZnO films deposited by DC arc plasmatron. The varied parameters were gas flow rates, precursor composition, substrate temperature and post-deposition annealing temperature.

Vapor of Zinc acetylacetone was used as source materials, oxygen was used as working gas and argon was used as the cathode protective gas and a transport gas for the vapor. The plasmatron power was varied in the range of 700-1500 watts. Flow rate of the gases and substrate temperature rate were varied in the wide range to optimize the properties of the deposited coatings. After deposition films were annealed in the hydrogen atmosphere in the wide range of temperatures.

Structure of coatings was investigated using XRD and SEM. Chemical composition was analyzed using x-ray photoelectron spectroscopy. Sheet conductivity was measured by 4-point probe method. Optical properties of the transparent ZnO-based coatings were studied by the spectroscopy.

It was shown that deposition by a DC Arc plasmatron can be used for low-cost production of zinc oxide films with good optical and electrical properties. Increasing of the oxygen content in the gas mixture during deposition allow to obtain high-resistive protective and insulation coatings with high adhesion to the metallic surface.

Keywords: ZnO film, DC Arc Plasmatron, Deposite