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Production And Investigation About Nano Structures And Optical Properties Of Zns/ Ag/Glass Multi Layer

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Abstract: ZnS/Ag/glass multilayer in high vacuum condition and vertical accumulation angle has been determined prepared by resistance evaporated method with 88.3 nm thickness for Ag layer and 80 nm thickness for Zns layer. Accumulated temperature of Ag layer was 28°c but for Zns layer Accumulated temperature was100°c. The Atomic Force Microscopy (AFM), optical Spectroscopy and XRD analyses are perfectly accomplished for this multilayer. It has tried that the results of this research have a positive effect on nuclear energy.

Key words: AFM; XRD; spectrophotometer; nanostructure; Ag.

INTRODUCTION

The addition of soluble zinc additives to PWR primary coolant leads to incorporation of zinc in the nickel substituted ferrite films and the inner chromites layers that form on nickel based alloys exposed to primary water. The main goals of using zinc injection are (a) reduction in plant radiation fields and (b) mitigation of PWSCC. Initial studies indicated that zinc injection into primary water was in successful delaying PWSCC initiation and that the effect is related to the zinc injection concentration. Subsequent analysis has indicated that the effectiveness of zinc injection as a PWSCC inhibition agent is related to the integrated quantity of zinc that ends up in the corrosion film of PWSCC susceptible nickel based alloys and welds. The amount of zinc in the films is related to the average zinc concentration present in the coolant and the time present. As such, the integrated zinc concentration, as defined by the 'ppb-mo' integrated exposure, is thought to be a good indication of the effectiveness of zinc for infiltrating the corrosion product film. (BYERS, W.A., R.J. JACKO, 1994; GOLD, R.E., et al., 1994)

Zinc sulfide (ZnS) is a wide gap and direct transition semiconductor (Berger, L.I., B.P. Pamplin, 1993). It is an important device material for the detection, emission and modulation of visible and near ultra violet light (Nicolau, Y.F., et al., 1990; Brus, L.E., J. Phys, 1986). Semiconductor nanoparticles, which have changed properties resulting from quantum confinement, have drawn considerable interest and are currently being investigated (Brus, L.E., J. Phys, 1986; Wang, Y., N. Herron, 1991). ZnS is also currently used as a shell or capping layer in core/shell nanoprobes such as CdSe/ZnS core/shell structures (Thakur, A., C. Fradin, 2005).

Silver nanoparticles are of current importance because of its easy preparation process and unique optical, electrical, and thermal properties. The electrical conductivity of polyaniline-silver nanocomposite increases with increase in silver nanoparticles content than that of pure polyaniline (Gupta, K., et al., 2010; Barnes, W.L., et al., 2003). In the synthesis of nanoparticles, it is very important to control not only the particle size but also the particle shape and particle size distribution as well. In the present investigation, the synthesis of silver nanoparticles and thin films by wet chemical solution route (Wang, X., et al., 2005) has been discussed. Such properties and applications strongly depend on the morphology, crystal structure, and dimensions of silver nanostructures. Over recent years, silver thin films have been a subject of intensive investigations because of excellent optical, electrical, catalytic, sensing, and antibacterial properties (Saito, Y., et al., 2002; Lee, D., et al., 2005) and subsequent applications.

Experimental Details:

Under layer was made from glass (laboratory smear) in 2.54 x 7.62 mm and thickness of 1-1.2 mm. these under layer has been cleaned by substratum bath for 15 minutes in Pure acetone and 15 minutes in absolute alcohol. Supported Rotary pump used for vacuum to 10^{-3}tor then with main pump reached 10^{-6}tor. all layers accumulation angle was optimized and vertical. Distance between boat n to under layer was about 45 cm and the diameter of supported under layer was 50 cm. boats used was tungsten for silver pieces and molybdenum for ZnS powder . Silver pieces were in silver or gray color and ZnS powder was in white color. Accumulation temperature for silver particles was 28 degree Celsius or room temperature and accumulation temperature for ZnS was 100 degree Celsius. The thickness of both layers has been measured by crystal quartz device which was computerized program and installed in the machine. The effort was to make both layer in same diameter which was achieved and silver layer was 88.3 nm and ZnS was about 80 nm.

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RESULT AND DISCUSSION

The Atomic Force Microscopy (AFM), spectrophotometer and XRD analyses are perfectly accomplished for this multilayer and the results are mentioned in detail.

Figure. 1. shows the microscopic image of 2 dimension (2D) atomic force and Figure 2 show the microscopic image of 3dimension (3D) atomic force of four layer glass ZnS/Ag/glass

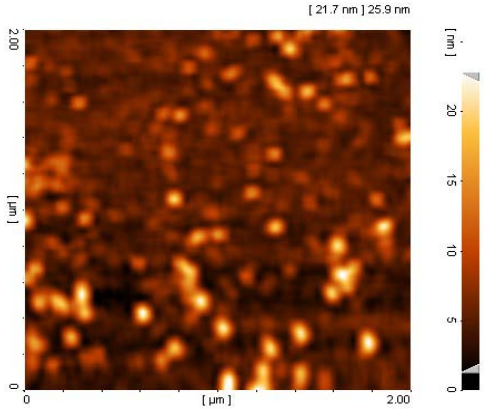

Fig. 1: 2 dimension (2D) AFM images of the sample ZnS/Ag/ glass

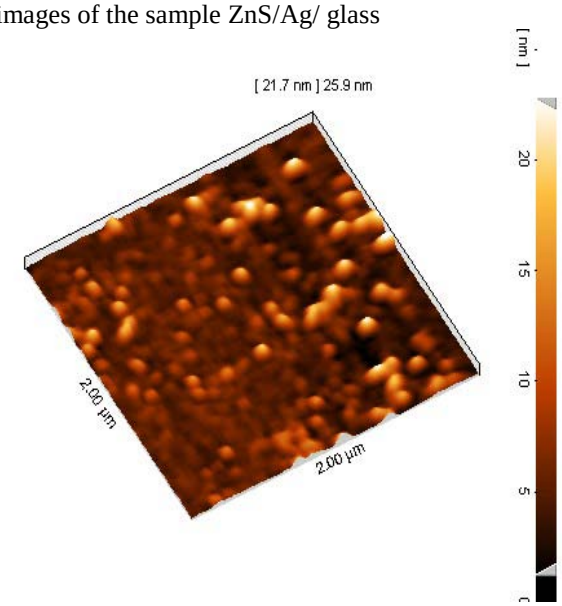

Fig. 2: 3 dimension (3D) AFM images of the sample ZnS/Ag/ glass

The thickness of this layer is about 168.3nm. The thickness of Ag layer in room temperature is 88.3 nm and ZnS at 100°c is 80nm. The median curve measurement of this layer (four layers)is 21.2nm.

Figure. 1. and 2 have been taken by 2µm×2µm magnification. As it shows, over all surface structure of Ag/ glass is different with ZnS/glass. Pens with cone-shaped tip which are a mixture of Ag and ZnS, also the hole between them are obvious. In some area the look like denser while in other parts they look like cone-shaped.

Figure. 3. show the microscopic image of atomic force at 0.2 µm × 0.2 µm magnifications for multilayer's made for this project. The median curve measuring for surface was 4.88 nm, surface appear as chain of hills with holes between them It is obvious when magnification of the surface get deeper connection of points and their relation with holes get clearer.

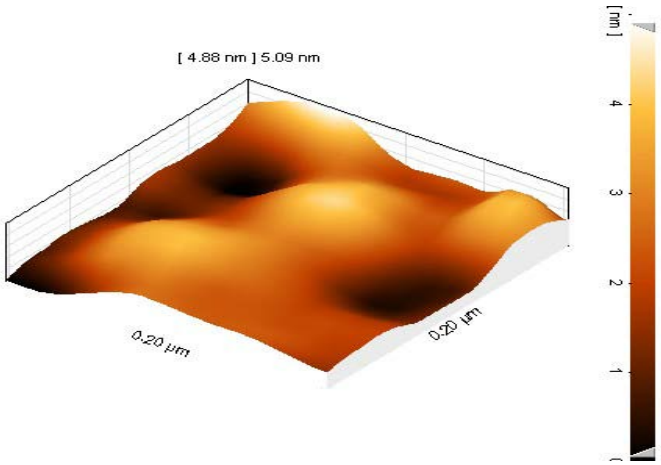

Fig. 3: 3 dimension (3D) AFM images of the sample ZnS/Ag/ glass

Figure. 4. shows the size of the points of these dots with red, blue and green arrow. Fig. 5. show profiles of these three points, red point has maximum thickness 11.8nm, blue point with maximum 11.3nm and green point with maximum 7.64 nm. Therefore, with attention to the thickness of previous analyses of ZnS points, we should see some combination between ZnS and Ag.

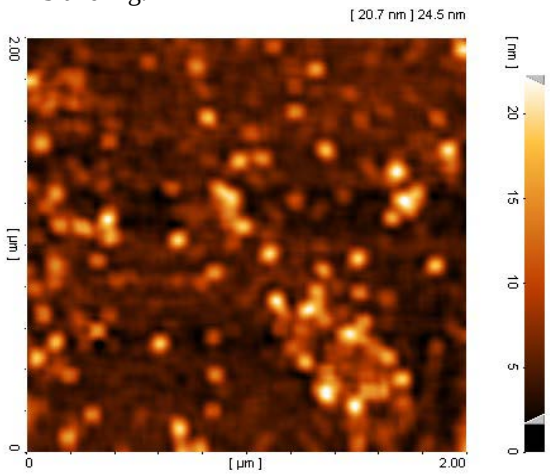

Fig. 4: 2 dimension (2D) AFM images of the sample ZnS/Ag/ glass

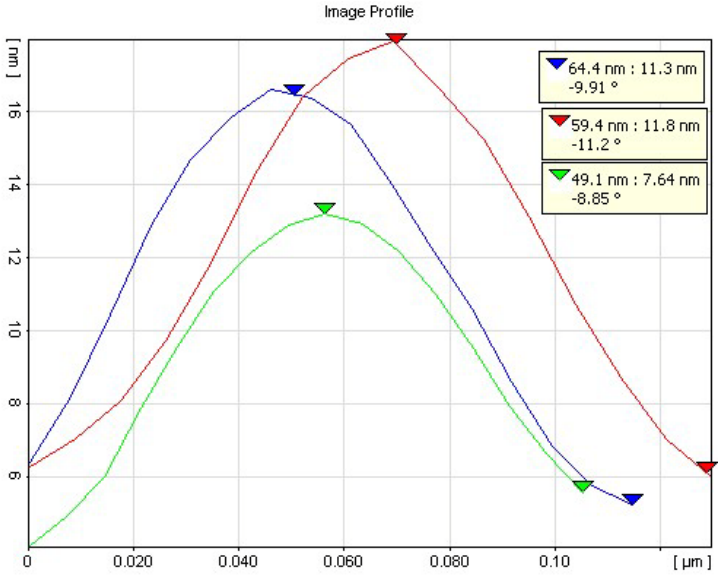

Fig. 5: Image profile of the sample ZnS/Ag/ glass

Figure. 6. shows the scatter of X ray on four layers. As it shows the complete graph NOISY first acquired wide peaks which are relevant to amorphous under layer of the glass. In addition, in some area peaks are more obvious which show the start of crystallisation due to Zns. Over all, use of Ag as under layer for Zns shows that it can play important role for crystallisation in top layer. By increasing the thickness of this layer alongside with heat treatment, we can get better crystallization

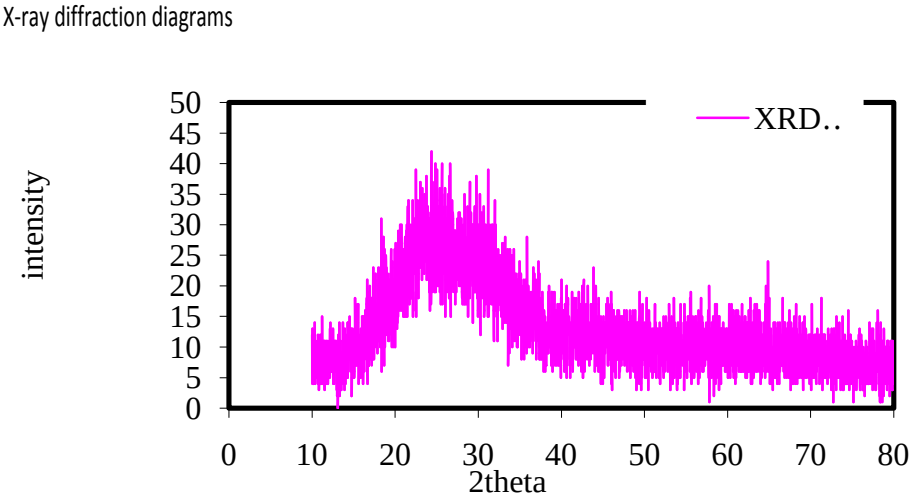

Fig. 6: XRD pattern of ZnS/Ag/glass

Figure. 7. shows the transmittance of few layer. we see transmittance behavior between Ag and ZnS. Maximum transmittance for Ag is about 65% and ZnS about 98% with adding these two layer on top of each other maximum transmittance will be 63% which is quite approval by previous graphs data and prove these four layers.

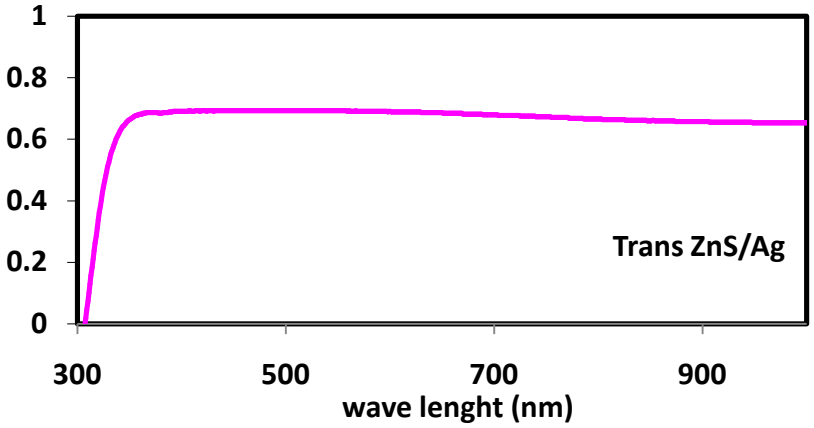

Fig. 7: Transmittance diagrams of the sample ZnS/Ag/ glass

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