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Producing and Investigating Structural Properties of the Semiconductor Thin Layer of Magnesium Fluoride on Glass

Sanaz Sepehri and Haleh Kangarlou

Department of Physics, faculty of science, Urmia Branch, Islamic Azad University, Urmia, Iran.

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ABSTRACT

Background: Thin-film technology is rapidly developing today. They are used to improve the surface properties of thin films. Usefulness of the properties of thin layers and interesting study on the behavior of two-dimensional solid led to the special interest both in science and in technology of thin films Atomic Force Microscopy (AFM) and X-Ray diffraction (XRD) are two effective methods, for obtaining nano structures of nano layers and nano particles. Also by AFM method we can calculate roughness, image profile, image voltage profile and phase images. XRD method also can obtain crystallographic of produced layers and nano particles and Miler indices. There for these two analysis along with each other can determine the properties of productions. For example electric conductivity, height of grains, homogeneous and heterogeneous productions. **Objective:** To investigate about structural properties of MgF_2/glass thin layers at room temperature, a physical vapor deposition method (heat evaporation) in ETS160 coating planet were used to produce semiconducting nano layers on glass substrates. The thickness of nano layer is about 80 nm. **Results:** Two and three dimensional AFM images of MgF_2/glass under HV conditions at room temperature were obtained. Two and tree phase images of produced nano layer were obtained. Image profiles and image voltage profiles also XRD patterns were obtained. **Conclusion:** AFM images show that MgF_2/ glass nano layer is homogeneous and there are needle like grains on glass substrate. In general, MgF_2/glass showed very little conduction that due to material's energy (about 12ev in bulk mood) it is quite natural.
XRD diagram is very noisy that it was due to the used substrate of amorphous (glass) in the experiment.

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INTRODUCTION

Today's thin-film technology is very broad and now nano thin film making has developed toward nanotechnology. But nanotechnology is the interesting field of science and technology that can replace surprisingly large and unprecedented chance on the horizon, i.e. the chance of ordering and restructuring of molecular structures (Jesse., A., 2010). Nano technology will make a great effect on anything. Nano materials are motivated to apply new technologies because they will develop new optical, electrical or magnetic properties (Akbarzadeh., A., 2010). The thin layer of a material or substances said to be a surface coating or other materials causing new electronic, physical and mechanical properties that they have neither the properties of the layering radiant and nor the properties of surface layer that accumulated on it. Basically layers composed of layers of metal, semiconductor and insulator layers are formed that in this study the focus is on semiconductor substrates. Layers used in this study is one of the most widely used semiconductor layers in industry. In transit semiconductors are structurally similar to the insulation at very low temperatures. Adding impurities to a semiconductor creates a new mode within the energy gap (Bilberq.,*et al.* 2010). Magnesium Fluoride is one of the most important alkaline-earth fluorides that are important due to widely used basis for antireflection coatings and optical polarization as an optical material (Fanglin., *et al.* 2000). Mgf_2singlecrystalis known because of its transition al nature in the vacuum ultra violet region as an optical material for semiconductor lithography(Clark., F., and Youngx., C., 2012). Since thecrystalMgf_2 can transmit a wide range of wave lengths, So lenses and prisms that are made from this material can transmit the wavelengths range from nm 0.12 (vacuum ultra violet gap) to 8 nm. With lithium fluoride, an Mgf2made of two substances that can transfer a wave length of 121 nm in the range of vacuum ultraviolet, and this is the main use of this material(Bozhevolnyi., S., 2006).

Corresponding Author: Haleh Kangarlou, Department of Physics, faculty of science, Urmia Branch, Islamic Azad University, Urmia, Iran.

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MATERIALS AND METHODS

To make the layers of the study, physical thermal evaporation technique (PVD) and the evaporation resistance were selected. Sub layers were selected from glass substrates (slide test). The reason for this choice is the availability and cost of glass in order it will be easy to replicate the experiment due to the above-mentioned reasons.

Plant needed to replace the springs on magnesium fluoride was selected Molybdenum plant. Magnesium fluoride spring was the white powder. Vertical deposition angle for all layers was considered in ideal conditions. Deposition temperature for magnesium fluoride was selected room temperature (28 C °). Initially the layer of Mgf_2 was made on a glass substrate and its thickness was determined by Krystal quartz thickness and its thickness determined 80 nm. Then advanced laboratory tech and nano-level technology used to determine the structural properties of layers. Advanced atomic force microscopy (AFM), X-Ray diffraction (XRD) have been fully examined.

RESULTS AND DISCUSSION

Figure 1 shows two-dimensional image of atomic force microscopy for the sample Mgf_2 / glass with thickness of 80 nm. Average thickness is 9.66 nm. Dimensions of measurement are 5µm * 5µm. Surface is full of high levels of fine-grain Mgf_2 and black spaces between the grains are clear.

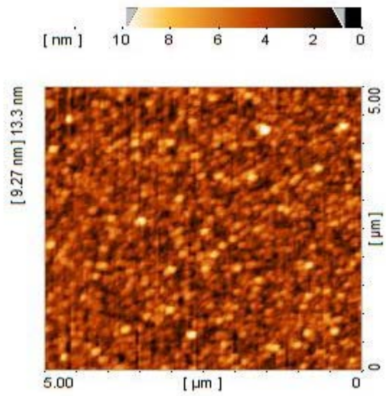

Fig. 1: Two-dimensional image of AFM in Mgf_2 / glass.

Figure 2 shows three-dimensional image of atomic force microscopy for the sample Mgf_2 / glass with thickness of 80nm. Dimensions of measurement are 5µm * 5µm. In this Figure seeds and empty spaces are clearly visible.

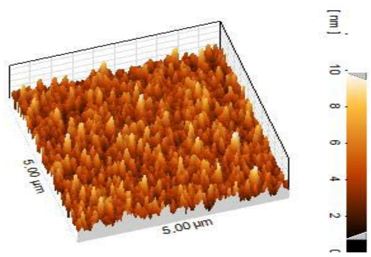

Fig. 2: Three-dimensional image of AFM in Mgf_2 / glass.

Figure 3 shows two-dimensional phase in Mgf_2 / glasslayer with a thickness of 80 nm in size 5µm * 5µm. As you can see the surface is in the three colors that it is due to the impurity of layer.

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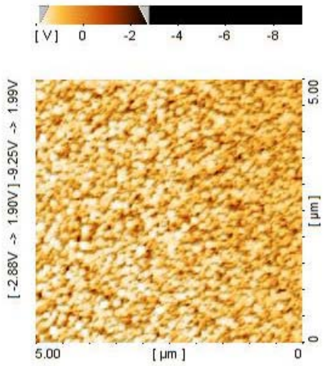

Fig. 3: Two-dimensional phase in Mgf_2 / glass.

Figure 4 shows three-dimensional phase for layer Mgf_2/ glass with a thickness of 80 nm in size 5μm * 5μm. The grains are markedly visible.

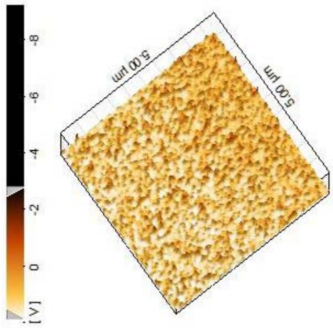

Fig. 4: Three-dimensional phase in Mgf_2/glass.

Figure 5 shows two-dimensional phase for layer Mgf_2 / glass with a thickness of 80 nm in size 2μm * 2μm. As it is visible, an area with pink arrow is determined that is for distinguishing the voltage in the determined grains.

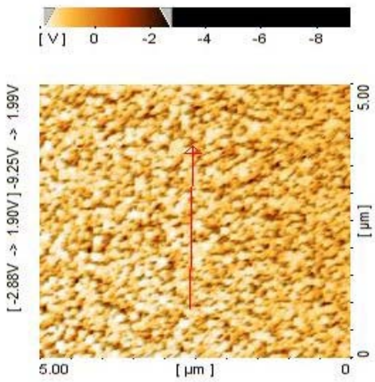

Fig. 5: Two-dimensional phase in Mgf_2 / glass.

Graph (1) shows the profiles of marked grains in Figure 5. As it is clear voltage alarming with same frequency. In general this layer showed low conduction that regarding its energy (about 12eV in balk manner) is completely natural.

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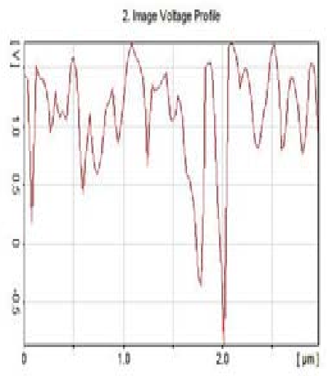

Graph 1: The profiles of marked grains in Figure 5.

Figure 6 shows X-ray diffraction diagrams for Mgf_2/ glass samples.Considering that the thickness of all layers and accumulation temperature have shown themselves in the form of amorphous,there is no specific structural peaks, broad peaks in the range of 20 to 30 degrees is due to the glass structure and the reason for being noisyis because of amorphous substrate (glass) used in the experiment.

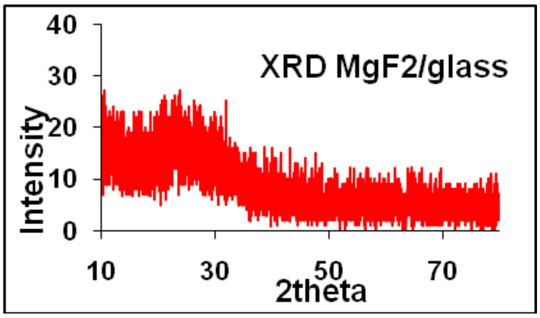

Fig. 6: XRD pettern of ZnS/glass.

Conclusion:

The film layer MgF_2 /glass was constructed on glass substrates using (ETS160) under high vacuum conditions at room temperature with vertical angle by physical thermal evaporation method. Nano layers' thickness was determined by a quartz crystal device. Thickness of 80 nm was obtained for multi-layer. To examine the structure of a multi-layer, analysis of atomic force microscopy (AFM) and X-ray diffraction (XRD) was used.

In general, MgF_2/glass showed very little conduction that due to material's energy (about 12ev in bulk mood) it is quite natural.

XRD diagram is very noisy that it was due to the used substrate of amorphous (glass) in the experiment.

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