THE OXIDE LAYERS DEPOSITION ON III – V SEMICONDUCTOR NANOPOROUS MATERIALS

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The peculiarities of the deposition process in dependence of the porous layer thickness were investigated. The porous layers of III-V semiconductor n-InP have been obtained by the anodic dissolution in 5% HCl. The diameter of pores reaches of about 80 – 100 nm and degree of porosity ~ 55 – 60%. The porous layers thickness was changed from 2 μm to ~ 40 μm.

The chemical composition of the obtained structures were investigated in dependence on the thickness of the porous layer (5-40 μm) on the surface of InP crystals with the aid of SEM and determination of elements distribution by Tescan Oxford Instruments INCA Energy EDX. Cross sections of the obtained structures have been prepared for these investigations. The comparison of the properties of layers which have been obtained under the following different conditions was carried out.

1. Thermal treatment in O_2 at 460 ^oC during 120 s;
2. Deposition of SnO_2 from alcohol solutions of 1M $SnCl_4$ at T = 460 ^oC during 60 s;
3. Deposition of ITO from ethilacetate solutions at T = 460 ^oC during 60 s.

The obtained results show:

1. In all cases the oxidation of the porous layer occur. The percentage of O_2 is 50-60 atomic % and slowly depends on the thickness of the porous layer. This percentage almost does not change in dependence on the distance from the layer surface. In the whole volume of the semiconductor the stoichiometric relation (In/P ~1) is maintained and oxidation is absent;

2. In the whole porous layer independently on their thickness the In/P relation is close to 1, however some divergence from the stoichiometry have been observed;

3 At the deposition of SnO_2 independently on the porous layer thickness Sn penetrates up to the depth of 3 μm with the diminution of the concentration at mowing away from the layer surface;

4. At ITO deposition Sn is concentrated only on the surface of the sample and does not penetrate into the volume of the porous layer;

5. At the deposition of SnO_2 a uniform oxide layer is obtained. This layer is composed from different oxides: Sn oxide (~15 atomic % Sn), In and P oxides (~ 9 atomic % In and 7 atomic % P), but the layer is porous. The best layers with less porosity are obtained in the case of InP porous substrates with the thickness up to 5 μm. It must be noted that the notion “porosity” is employed by us in two senses. One of them is the porosity on the surface of the crystalline substrate which is obtained by anodic dissolution. The other is the porosity of the deposited oxide layer, in other words, the presence of miniholes in the layer.

6. At ITO deposition the formation of drops was observed independently on the thickness of the porous substrate.

We can conclude that the best samples for further investigations are the structures obtained by the deposition of SnO_2 on InP substrates with porosity layer thickness up to 5 μm.

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