Photoluminescence study of the PbSe growth on indium phosphide substrates.

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Lead selenide (PbSe) is an interesting narrow-gap (0.278 eV) semiconductor which is used for infrared detectors. Furthermore PbSe presents large quantum size effects due to the very low values of electron and hole effective masses [1]. Thus an increase in the effective bandgap can appear for a crystallite size as large as 80 nm. This increase is accompanied by a strong shift towards higher photon energies of the absorption coefficient curve.

It has been shown that this compound can be grown from the liquid phase by chemical solution deposition and by electrodeposition. The composition of the solution and the choice of the cathodic potential, in the case of electrodeposition, allows to control the crystallite size and in restricted conditions, an epitaxial growth on InP single crystals is obtained [2].

In the present work, the signal of the photoluminescence (PL) provided by the InP substrate at 880 nm, has been used as an *in situ* or *ex situ* probe to follow the deposition process. The PL signal is dependent on the modification of the optical parameters of the PbSe/InP interface during the growth.

The PbSe chemical solution deposition is a relatively slow process, the slower is the process, the lower is the bath temperature. For a given deposition temperature, the time dependence of the PL signal is for a part related to the surface coverage, for another part to the optical properties of the deposited layer.

It has been shown that homogeneous PbSe electrodeposits can be obtained in the presence of a large amount of cadmium ions in the solution [2]. XPS surface analysis showed an excess of cadmium at the very InP/PbSe interface [3]. The PL signal is used to probe the superficial chemical bonds for different compositions of the electrolyte. Additionally the PL study is extended to the UPD mechanism of Pb and Cd, implied in the PbSe growth mechanism [3].

References :

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