

GROWTH OF HgSe BY ELECTROCHEMICAL ATOMIC LAYER EPITAXY (EC-ALE)

Venkatram Venkatasamy
UGA Department of Chemistry

John Stickney
Professor
UGA Department of Chemistry

II-VI compound semiconductors have a lot of potential application in the electronic industry. HgSe is one of the important compound semiconductor, with possible uses in the optoelectronic application, IR detectors, IR emitter, tunable lasers and thermoelectric coolers. HgSe has been formed by various methods like MBE, chemical bath deposition and cold traveling heater method (CTHM).

HgSe thin films has been formed using Electrochemical atomic layer epitaxy (EC-ALE). It is the electrochemical analog of atomic layer epitaxy (ALE), which makes use of under potential deposition (UPD). It is used in EC-ALE to achieve monolayer by monolayer growth.

The solutions used included 1.0mM HgCl₂, pH 2.00, complexed with 10mM EDTA. The concentration of SeO₂ solution was 0.25mM, pH 3.00. A 0.5M Na₂SO₄, pH 4.0 blank solution was used as well. Microscope glass slides with a 5nm Ti adhesion layer and 300nm Au were used as substrates. The films were deposited using the specially designed Electrochemical flow deposition system.

The films were studied as a function of Hg solution parameters and its deposition potential, to find the optimal deposition conditions. The deposits were characterized using X-ray diffraction (XRD), Electron probe micro analysis (EPMA), Atomic force microscopy (AFM) and Fourier transform infrared spectroscopy (FTIR). XRD diffraction pattern indicated the films to be Zinc blende. EPMA results indicated the films as stoichiometric, with less than 5% excess selenium. Infrared absorption measurements showed direct and indirect badgaps of 0.42eV and 0.88eV.