

Seminar

Institute for Plasma Research

Title: Optimizing thin-film based buffer layer and transparent conducting oxides performance for device applications

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Venue: Join the talk online:

https://lobby.ipr.res.in/Dr.MargiJani_PDFTalk

Abstract

In family of chalcogenide earth abundant materials like $\text{Cu}_2\text{ZnSnS}_4$, Cu_2SnS_3 and SnS , $\text{Cu}_2\text{ZnSnS}_4$ (CZTS) contains beneficial qualities of economic process ability, very high absorption coefficient in the visible spectrum and intrinsically p-type conductivity. A choice of the buffer layer and selection of material having suitable band structure are important parameter for the device application. Alternative buffer material like a doped ZnO is considered where an attempt is made to control the band offset between the buffer and the absorber layers by the variation in precursor concentration of the raw material. A strain induced shift of band gap in the range 2.8 – 3.6 eV is noticed in the system. Structural, electrical, optical, and morphological properties of Zn(O,S) system is studied. Furthermore, a cation site doping in ZnO by indium and annealing process improves its electrical properties to greater extent. Indium doping in the Zn(O,S) system is developed and subsequent annealing studies gives its application as charge membrane layer is possible when applied between the buffer and the TCO (Transparent conducting oxide) layers of the device. A vacuum based plasma sputter system is used for the deposition of Mo contact layer in the device to characterize dc current-voltage measurement. In:ZnO is also developed and its optical transmission as well as electrical conductivity are improved through annealing in different atmospheric conditions. 1-D numerical simulation is carried out for CZTS/Zn(O,S) shows that band gap variations are beneficial for reducing the band offsets along with hetero-junction, which plays a deterministic role in optimizing the performance parameter for the device application.
