# Suppressing Buried Interface Nonradiative Recombination Losses Toward High-Efficiency Antimony Triselenide Solar Cells

**Guojie CHEN** [1-2], Michel Cathelinaud [1], Shuo Chen [2], Hongli Ma [1], Xianghua Zhang [1], Guangxing Liang [2]

[1] CNRS, ISCR (Institut des Sciences Chimiques de Rennes), UMR 6226, Université de Rennes, Rennes F-35000, France
[2] Shenzhen Key Laboratory of Advanced Thin films and Applications, Shenzhen, Guandong 518060 PR. China

Contact email address: guojie.chen@univ-rennes1.fr

**Abstract**

Antimony triselenide ($Sb_2Se_3$) has possessed excellent optoelectronic properties and has gained interest as a light-harvesting material for photovoltaic technology over the past several years. However, the severe interfacial and bulk recombination obviously contributes to significant carrier transport loss, thus leading to the deterioration of power conversion efficiency (PCE). In this work, buried interface and heterojunction engineering are synergistically employed to regulate the film growth kinetics and optimize the band alignment. Through this approach, the orientation of the precursor films is successfully controlled, promoting the preferred orientational growth of the (hk1) of the $Sb_2Se_3$ films. Besides, interfacial trap-assisted nonradiative recombination loss and heterojunction band alignment are successfully minimized and optimized. As a result, the champion device presents a PCE of 9.24% with short-circuit density ($J_{SC}$) and fill factor (FF) of 29.47 mA cm$^{-2}$ and 63.65%, respectively, representing the highest efficiency in sputtered-derived $Sb_2Se_3$ solar cells. This work provides an insightful prescription for fabricating high-quality $Sb_2Se_3$ thin film and enhancing the performance of $Sb_2Se_3$ solar cells.