

Title: Prospects and Limitations in Thin Film Photovoltaic Technology R&D

Abstract:

Countries around the world are convinced to rely on Renewable Energy Sources (RES) for their future energy roadmap. In just about 60 years, since the inception of the crystalline silicon based solar cell in Bell Labs, researchers have been working rigorously to achieve utmost benefit in terms of conversion efficiency at the least cost from these. Consequently, mega to giga-watt-peak large-scale solar (LSS) farms have become trustworthy reality to date. Even though the first generation solar cells, which are mainly crystalline or multi-crystalline silicon based, are still dominating the major market share of around 90%, the search for other options has brought over many other potential candidates such as amorphous silicon, cadmium telluride, copper-indium-sulphide as 2nd generation ones since early 70s. However, most of these are thin films based solar cells that are sometimes thinner to the theoretical limit and require multiple supporting layers to form the complete photovoltaic devices in homo or hetero junction configurations. Semiconductor material science including fabrication technology on many compound semiconductors has been evolving over the period of time to support various wings of PV R&D in both traditional or futuristic ways. Even though, some of the thin film photovoltaics are now in commercialization stages whereas conversion efficiencies continue to mark over 20% till present (e.g. CIGS, CdTe), new arena has opened up for the most challenging but prospective device structures such as tandem/multi-junctions of different materials. This talk will include most prospective thin film solar cells from its inception to research arena towards successful commercialization as well as future direction of R&D in some challenging ways. Moreover, prospects and limitations with existing configurations will be discussed and the potential solutions with the incorporation of novel but inexpensive ideas as have been carried out will be introduced.