

Nano coating for energy saving and generation

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Nano-coatings are keen for solar energy saving and harvesting applications. Energy saving smart coating is much sought-after to reduce the CO₂ emission and global warming. Among several technologies, dielectric/metal/dielectric (DMD) multilayer passive coating is a promising technology to develop low cost affordable solar film which will reject infrared (IR) radiation and will keep indoor cool, while allows visible light. DMD based multilayer is an effective way to save electricity. For an example, TiO₂/Cu/TiO₂ structure reflects infrared radiation in the solar spectrum where as it allows visible transmission, It is a potential candidate for residential and automobile smart windows application. By tuning design of the DMD multilayer, solar film can be developed on flexible substrate for different applications.

On the other hand, energy generation using renewable technology is key to reduce the power generation through non-renewable energy generation. Photovoltaic technology is mainly leading for renewable energy generation. Even though, silicon based solar cells are currently leading technology, earth abundant materials are investigated for the development of low cost solar cells for large scale deployment. Metal oxides and sulfides are promising candidate for the development of non-silicon based solar cells. Nano-coatings using metal oxides and sulfide based materials are being investigated for the development of solar to electricity at low cost. Absorber quality and interface properties are mainly responsible to enhance the efficiency of the device. We have investigated optical and electrical properties of sputter deposited cupric oxides (CuO) and copper-zinc-tin-sulfide (CZTS) films for thin film based solar energy harvesting application. Sputter grown CZTS thin film have been evaluated for the low cost solar cells applications. Formation of thick interfacial layer during thermal treatment degraded device performance. Interfacial engineering is key to control MoS₂ formation and secondary phase formation. In this talk, I will present sputter grown nano coating for energy saving and generation and will discuss about the importance of materials design and synthesis to achieve best performance of the devices.