Low temperature healing, photocatalytic self cleaning coatings for solar cell covers and glass surfaces

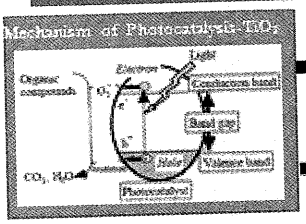
The project was aimed at development of highly photoactive nano size titanium oxide stable colloidal suspensions from aqueous route and further development of transparent coating on solar cell cover glass. Low temperature coatings were made from coating precursor consisting of UV curable polymer additives and protecting the nano titanium oxide particles through silane capping. Annealed coatings were also developed on glass for use at higher temperatures for various purposes and extended to ceramic surfaces.

While the increased photo activity and visible light activity were achieved through multiple dopants, hydrophobicity was achieved through design of precursor composites and controlled surface roughness of coatings. In addition, photo luminescence was achieved through incorporation of europium and terbium ions in titania matrix. Such multifunctional compositions are very novel and highly applicable for a variety of applications. The compositional effect, processing parameters, coating characteristics and the performance data were documented in detail and appropriate correlation was made which allow selection of appropriate parameters for any desired product range.

The laboratory findings were scaled up to demonstration levels for further adoption by the industrial collaborator (Bharat Heavy Electricals Limited, Bangalore) and efforts for absorption into the commercial production channel are in progress. The field demonstration set up consisting of sets of commercial size solar panels with and without coated surfaces installed in NIIST with provision for on line measurement of efficiency continuously for 24 hours for a long period of 18 months indicated an advantage of 15% , which otherwise should have been lost due to surface contamination and masking of sun light.

Thus the project resulted in design and synthesis of high efficiency visible light active titanium oxide photo catalyst and introduced multifunctionality such as hydrophobicity and photo luminescence. The processes were demonstrated on large area solar panels as well as the technical feasibility of such coatings were established. The compositional effects and processing parameters on performance levels were correlated. In addition, demonstration of the salient features of the titanium oxide prepared under the project has been made with coatings on glass and ceramic surfaces, both in form of low temperature and annealed coatings. All the results were published in International scientific journals in about 12 publications, one patent and three PhD theses.

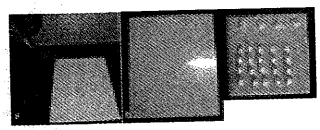
Deliverables of the Project on photo active multifunctional Titanium Oxide

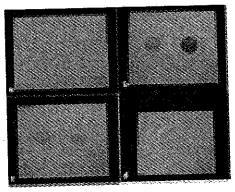


Technology for nano photoactive TiO_2

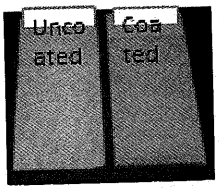
Technology for self cleaning coatings

Self Cleaning coatings

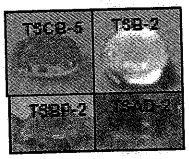




Nanotitania coating (left), (a) hydrophobic coating and Dye degradation efficiency of a titania coated glass slide after 2h sunlight exposure (right)



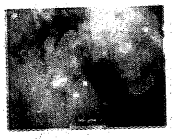
Coated glass



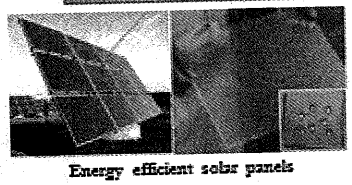
Hydrophobic

Collaboration-Bharat Heavy Electricals Ltd., Bangalore

Eu-doped titania



Tb-doped titania



Energy efficient solar panels