International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI)

Balapur P.O., Hyderabad – 500005, Telangana, India

High performance broad band antireflective coatings for optical, solar and display applications

Overview

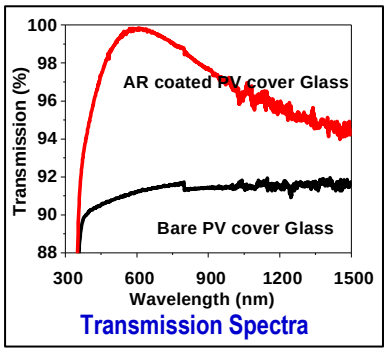
The constantly growing demand for optoelectronic and optical equipment in diverse areas, including consumer electronics and space exploration has created the need to identify the best ways to improve the efficiency of light collection. In this regard, development of broad-band anti-reflective coatings (BARCs) has attracted substantial research interest due to their high transmittance in a broad wavelength range (300–2500 nm). Due to their high refractive indices, optical elements like glass and polymeric transparent substrates suffer a reflection loss of about 8-9% in the visible spectrum of the solar radiation. Such reflection losses are undesirable and detrimental to the overall light to electricity conversion efficiency. Hence, BARCs that transfer maximum incident light over a broad range of wavelengths can help to achieve competitive conversion efficiencies in solar cells

Key Features

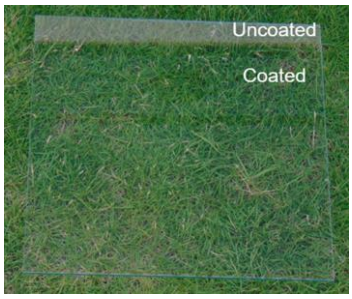
- High transmittances in visible and solar regions: >98 % (in visible) >96% (in solar)
- Low temperature curable (80-100 °C)
- High temperature stability: Max up to 1000 °C
- Weather stability: > 200hrs withstand in high humidity (>90%) at 50 °C
- High mechanical stability and Long durability
- Cost effective coating technique

Potential Applications

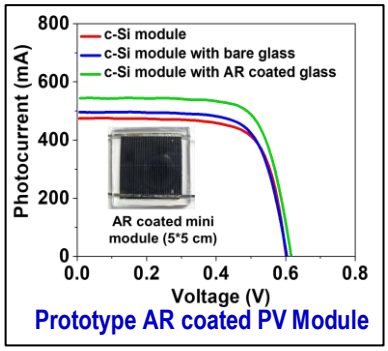
- Solar PV & CSP cover glass
- Optical lenses
- Video display panels
- Architectural glasses
- High power lasers



Transmission Spectra



AR coated PV glass



Prototype AR coated PV Module

Parameter	C-Si	Minimodule with bare glass	Minimodule with AR coated glass
V_{OC} (V)	0.602	0.603	0.615
I_{SC} (A)	475	496	544
FF	0.72	0.71	0.73
Eff(%)	13.06	13.28	15.27

Performance of BAR coated modules

Major Patents/Publications

- Indian patent Application no. 4041/DEL/2014, date of filling: 31.12.14.
- High Performance and Environmentally Stable Broad Band Antireflective Coatings using Novel Ink-Bottle Mesoporous MgF_2 Nanoparticles for Solar Applications, Solar Energy Materials & Solar Cells 159 (2017) 204–211.

Prototype Receiver Design and 1 m AR coated CSP cover glass tube

IPDI*	1	2	3	4	5	6	7	8	9	10
Activities	*Basic concepts and understanding ofunderlying scientific principles*	*Short listing possible applications*	*Research to prove technical feasibility for targeted application*	*Coupon level testing in stimulated conditions*	*Check repeatability/ consistency at coupon level*	*Prototype testing in real-life conditions*	*Check repeatability/ consistency at prototype level*	*Reassessing feasibility (IP, competition technology, commercial)*	*Initiate technology transfer*	*Support in stabilizing production*
Status										

IPDI: Intellectual Property Development Indices

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