ARCI's easy-to-clean coating technology can increase efficiency of solar panels

Scientists at the International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), an autonomous organization of the Department of Science and Technology, have developed nanoparticle-based coating for solar panels that can minimize dust deposition and enables easy cleaning by the action of water. It can prevent a reduction in efficiency of the panels due to soiling.

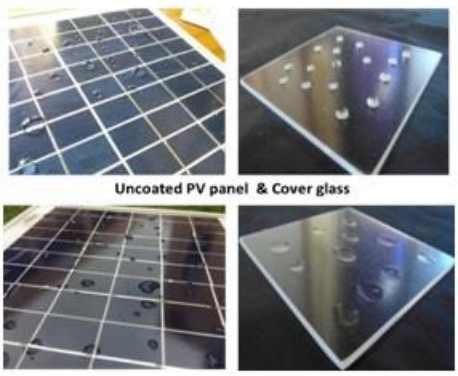
Solar panels are exposed to sunlight in open areas to achieve high conversion efficiencies, resulting in continuous contact of solar panels with severe weather conditions, dust and so on. Accordingly, solar panels are designed to withstand humid, corrosive, and dust-laden atmosphere for many years to provide a stable and reliable operation. Moreover, their conversion efficiencies, typically in the 20% range, are reduced due to soiling by dust, dirt, pollen, and other particles that accumulate on the solar panels over a period of time. The power production capabilities of an unclean solar module in high dust area can drop by 30-40% within 1-2 months. The surface of a solar panel having super-hydrophobic coating replicates lotus leaf features. The sprinkling of water effectively washes off the dust and other contaminants from the panel surface, similar to that of a lotus leaf. But most such products developed in the US and Europe are suitable for mild weather conditions and cannot tolerate harsh environmental conditions prevalent in India.

India also has the highest average soiling rate of 0.6 % per day as compared to 0.1 % in the US, 0.05 % in Japan and 0.02 % in Germany. This could be the most disconcerting phenomenon for solar power generation, specially when the country is aiming for a leap in solar power production.

So, there is an enormous requirement for self-cleaning (Easy-to-Clean) coatings on solar panels to encounter severe environmental conditions (high dust/dirt, high humidity, and corrosion).

Scientists at ARCI developed a high performance transparent easy-to-clean coating using functional nanoparticles, which stand out by its suitability for extreme Indian conditions of high temperature, humidity, varied natures of high pollutant level. This coating technology is suitable for easy application in an existing PV power generation field by simple spray and wipes techniques. This novel coating reduces the amount of dust deposited on the solar panels and cleans itself by the action of water on the modules. The key features of this novel coating are its low cost highly transparent nature (no loss in transmittance or power conversion efficiency), super-hydrophobic property (water contact angle more than $110^{o)}$,

high weather stability and high mechanical stability. It has a simple coating technique, easy scalability, curability at ambient temperature and can withstand long duration accelerated test.



ARCI's Easy to clean coated PV panel and cover glas

This coating has been validated in the laboratory conditions as per the international standards and successfully validated on ground-mounted and rooftop solar power plants located at various places in the country.

Two patent applications have been filed for this technology, and technological know-how has been transferred to NETRA (NTPC Ltd), New Delhi, for commercial utilization. More recently, an MOU has been signed with Marichin Technologies, Mumbai for technology transfer, which plans to mass-produce the easy to clean material for broader PV market absorption.

For more details, Dr S Sakthivel (ssakthivel@arci.res.in) can be contacted.

ARCI researchers with easy-to-clean coated 320 Watt silicon solar panel