National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Materials and Coatings

Self-Cleaning Coatings for Space or Earth

Transparent Electrodynamic Dust Shields Usable for Solar Cells

Reducing dust accumulation on any surface is key for lunar missions as dust can damage or impair the performance of everything from deployable systems to solar cells on the Moon's surface. Electrodynamic dust shields (EDSs) are a key method to actively clean surfaces by running high voltages (but low currents) through electrodes on the surface. The forces generated by the voltage efficiently remove built up, electrically charged dust particles.

Innovators at the NASA Kennedy Space Center have developed a new transparent EDS for removing dust from space and lunar solar cells among other transparent surfaces. The new coatings operate at half the voltage of existing EDSs while being 90% thinner. These capabilities are enabled by an innovative combination of electrode patterning and a thin silica protective layer. The reduced thickness and lower voltage operation expands possibilities for integrating EDSs onto transparent surfaces across industries.

BENEFITS

- Energy savings and enhanced safety: Operates at half the voltage of current EDS technologies.
- High performance: Demonstrated over 90% dust removal efficiency.
- Manufacturing scalability: Vapor deposition process enables large scale manufacturing.
- Versatility: Applicable to a wide range of transparent surfaces including solar cells, glass, and other materials.

APPLICATIONS

The technology has several potential applications:

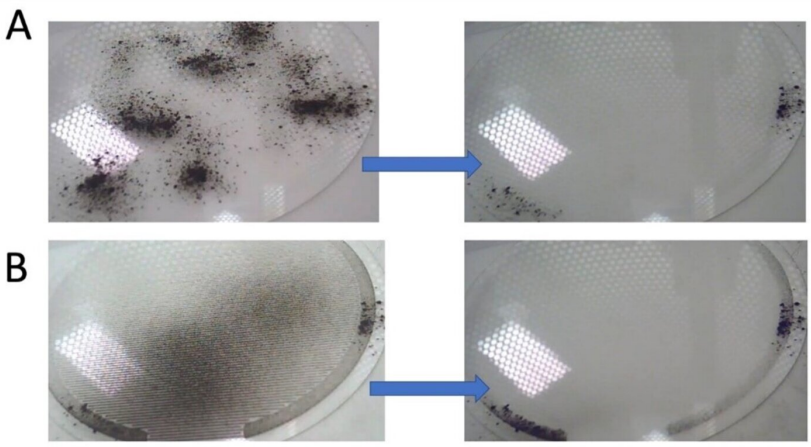
- Aerospace: solar cells, windows for spacecraft and stations, or spacesuit visors
- Terrestrial power: solar farms and rooftop solar panels
- Architecture: building windows
- Agriculture: windshields on farming equipment and windows or roofs of greenhouses
- Automotive: headlights, windshields, mirrors, and sensors on vehicles

THE TECHNOLOGY

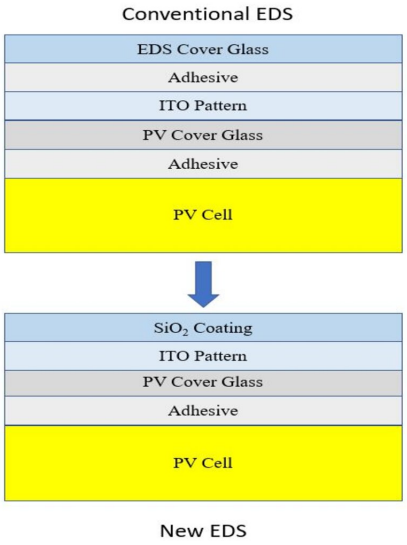
The new transparent EDS technology is lighter, easier to manufacture, and operates at a lower voltage than current transparent EDS technologies. The coating combines an optimized electrode pattern with a vapor deposited protective coating of SiO2 on top of the electrodes, which replaces either polymer layers or manually adhered cover glass (see figure on the right). The new technology has been shown to achieve similar performances (i.e., over 90% dust clearing efficiency) to previous technologies while being operated at half the voltage.

The key improvement of the new EDS coating comes from an innovative method to successfully deposit a protective layer of SiO2 that is much thinner than typical cover glass. Using vapor deposition enables the new EDS to scale more successfully than other technologies that may require more manual manufacturing methods. The EDS here has been proven to reduce dust buildup well under vacuum and may be adapted for terrestrial uses where cleaning is done manually. The coatings could provide a significant improvement for dust removal of solar cells in regions (e.g., deserts) where dust buildup is inevitable, but water access is limited. The EDS may also be applicable for any transparent surface that must remain transparent in a harsh or dirty environment.

The related patent is now available to license. Please note that NASA does not manufacturer products itself for commercial sale.



Examples of the EDS actively removing the dust from glass surfaces under vacuum when dust is placed by (a) a brush and (b) by a vacuum dust deposition system.



Schematics showing the layer stack of the new EDS compared to conventional transparent EDS coatings.

technology.nasa.gov

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

KSC-14465, KSC-TOPS-99

More Information

National Aeronautics and Space Administration

Agency Licensing Concierge

Kennedy Space Center

MS LASSO-012
Kennedy Space Center, Fl 32899
202-358-7432
Agency-Patent-Licensing@mail.nasa.gov

www.nasa.gov

NP-2015-02-1384-HQ