NASA TECH BRIEF

NASA Pasadena Office

Sheet Plastic Filters for Solar Cells

The problem:

To provide a lightweight system which protects solar cells on the surface of Mars from radiation and, especially, to prevent the degradation of solar cell surfaces by Martian dust storms. Ordinarily, cell covers or filters made from thin sheets of glass or silica are used to enhance the emittance properties of solar arrays; since the radiation environment on Mars is very low and the mission is so long that weight is an important factor, filters 0.076-mm thick (0.003-inch) were given consideration. However, since the dust of Mars may be a highly conductive form of iron oxide, it was considered necessary to cover all electrical connections to prevent short circuits; glass filters would be too heavy.

The solution:

Use thin sheets of plastic to cover the solar cell assemblies.

How it's done:

The transmission characteristics of a transparent film of poly(vinylidene fluoride) (PVF) are excellent and the polymer is unaffected by solar radiation in the near-ultraviolet, visible, and near-infrared regions of the spectrum. Moreover, it has excellent resistance to solar degradation; test samples of the transparent film have not discolored and still retain 50 percent of their initial tensile strength after weathering in a semitropical oceanic environment for 10 years.

The transparent PVF film [about 0.025-mm thick (1 mil)] is fastened to a solar cell by a silicone adhesive. Arrays of cells mounted on a solid backing plate are covered with a single sheet of the film and cemented in place; the finished coating eliminates the gaps between cells which would form a trap for accumulation of dust.

Electrical measurements of a solar cell with a PVF film showed only about 0.7 percent degradation at the maximum power point; this is comparable to the losses found when quartz filters are used. Moreover, it is anticipated that the flexible film has a better abrasion resistance to the sandblasting character of blown dust than the hard surface of glass or quartz filters.

In view of the excellent performance of solar cells covered with PVF films, the resistance of PVF to dust, its lighter weight, resistance to failure by shock, and the ease of installation, it appears that PVF films may be used to replace glass or quartz windows on solar cell arrays used to generate power on earth.

Note:

Requests for further information may be directed to:

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Patent status:

No patent action is contemplated by NASA.

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