April 1967

Brief 67-10102

NASA TECH BRIEF

Simplified Method Introduces Drift Fields Into Solar Cells

The problem:

Drift fields are advantageous in solar cells since they enhance the collection of minority carriers, resulting in higher conversion efficiencies. Radiation resistance is also improved since field-aided collection is less susceptible to radiation damage than simple diffusion collection. These advantages have in the past, been largely offset by the difficulty and expense of fabrication procedures that have involved diffusion periods of hours at elevated (~1100°C) temperatures with relatively thin (4 mils) blanks of material. Following formation of the drift field, an additional diffusion has been required to form the rectifying junction. Finally, output contacts must be applied to the device.

The solution:

A method that introduces the drift field at relatively low (~300°C) temperatures in short (½ to 1 hour) periods into solar cells that already incorporate their rectifying junctions and output contacts.

How it's done:

The desired impurity, lithium as an example, is introduced by placing a conventional solar cell in an environment containing the impurity and heating the solar cell. Lithium is placed on the N-type side of an N/P silicon semiconductor solar cell and the temperature is raised to 290°C and maintained for from ½ to 1 hour. This effectively diffuses the lithium into the cell, causing the base resistivity of the P-type material, next to the rectifying junction, to increase because of its donor nature. The resulting structure has a variation in impurity concentration in both the skin and base regions to lead to a drift field of proper sign to aid collection of minority carriers from these regions. Because most of the carrier collection normally comes from the base region of silicon solar cells, this represents an improvement to the original cell. Upon completion of the lithium diffusion, the cell is finished with an antireflection coating.

Note:

Inquiries concerning this invention may be directed to:

Technology Utilization Officer
Goddard Space Flight Center
Greenbelt, Maryland 20771
Reference: B67-10102

Patent status:

This invention is owned by NASA, and a patent application has been filed. Royalty-free, nonexclusive licenses for its commercial use will be granted by NASA. Inquiries concerning license rights should be made to NASA, Code GP, Washington, D.C. 20546.

Source: Paul Rappaport, Joseph J. Wysocki, and Bernard Goldstein
of Radio Corporation of America
under contract to
Goddard Space Flight Center
(GSFC-572)

Category 03