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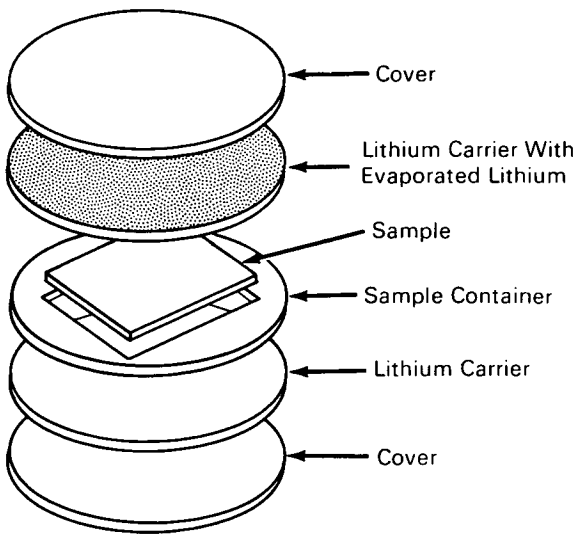
Diffusion Technique for Lithium-Doped Silicon



Wafer Sandwich, Exploded View

The problem:

To diffuse lithium into a silicon slice without damaging the surface of the slice.

The solution:

Construct a sandwich of five slices of silicon, with lithium dopant deposited on the outside surfaces of the second and fourth slices and the sample to be doped in the middle.

How it's done:

The sample to be doped is sandwiched between two carrier slices of silicon, on the outer side of which lithium-bearing dopant material has been deposited, either by evaporation technique or by painting with a solution of the material. Cover slices are placed over each lithium layer to minimize losses by oxidation and re-evaporation. Upon heating, the lithium diffuses through the carrier slices and into the sample wafer.

Some of the parameters which influence the diffusion process and which may be varied to control the characteristics of the doped sample wafer are as follows: (1) thickness of the carrier slices influences the rate of introduction of lithium into the sample; (2) different amounts of lithium on the two carriers can produce various gradients of dopant concentration; (3) temperature and exposure time influence the penetration depth and total amount of dopant introduced; and (4) alloying the dopant layer with slower diffusing materials such as tin, reduces the amount of lithium which permeates the carriers, and can be used to control the lithium concentration in the sample.

Notes:

1. By starting with a lithium-tin alloy dopant which is on the lithium-rich side of a two-phase region, the chemical activity of lithium on the carrier slice can be made constant over a range of lithium concentration (until the composition crosses the lithium-poor side of the two-phase region). Use of this property allows precise determination of the total amount of lithium introduced.
2. Information on previous work in this field may be found in NASA-CR-97077 (N68-35814), Development and Fabrication of Lithium-Diffused Silicon Solar Cells.
3. Requests for further information may be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland 20771
   Reference: TSP70-10148

(continued overleaf)

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No patent action is contemplated by NASA.

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