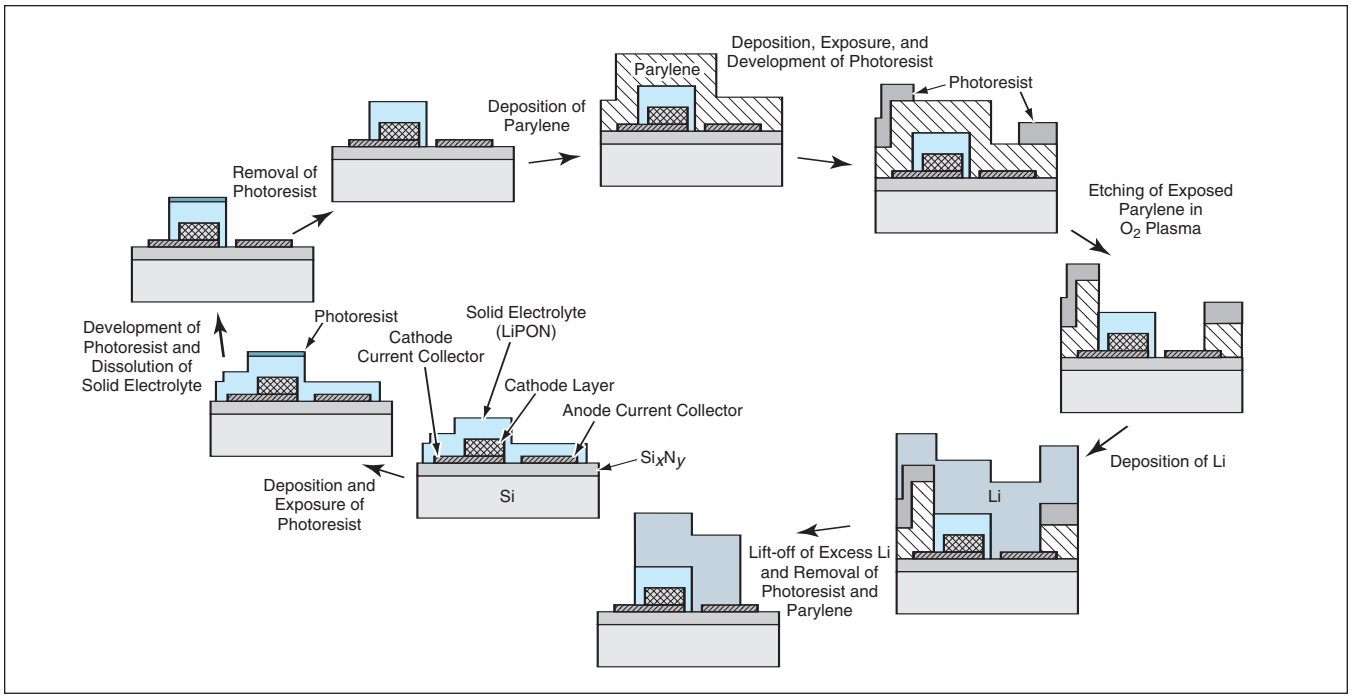
Improved Fabrication of Lithium Films Having Micron Features

Dry chemicals and a dry process are used to prevent undesired reactions.

NASA's Jet Propulsion Laboratory, Pasadena, California



A **Lithium Anode in a Microelectrochemical Cell** is fabricated in a dry process.

An improved method has been devised for fabricating micron-dimension Li features. This approach is intended for application in the fabrication of lithium-based microelectrochemical devices — particularly solid-state thin-film lithium microbatteries.

The need for this special process arises because lithium engages in undesired chemical reactions with water and with most of the chemicals commonly used in the microfabrication of silicon and other materials. The method described below involves the use of only water-free "dry" chemicals that are compatible with lithium. The figure illustrates the pertinent steps in the fabrication of a microelectrochemical cell containing a lithium anode.

The following steps are performed in sequence:

1. The solid-electrolyte layer is covered with AZ 1518 (or equivalent) photoresist, which is then exposed to ultraviolet light in a pattern that defines the areas from which the solid electrolyte is to be removed.
2. The photoresist developer dissolves both the photoresist and the underlying solid electrolyte from the aforementioned areas, leaving developed photoresist and underlying solid electrolyte only in a defined area.
3. The developed photoresist is removed by use of dry acetone, leaving the solid electrolyte in the defined area.
4. A layer of parylene 2 to 4 μm thick is deposited over the entire workpiece.
5. NR 5-8000 (or equivalent) photoresist is applied, exposed, and developed. The opening between areas covered by developed photoresist defines the anode area on which lithium is to be deposited.
6. The exposed parylene is etched away in oxygen plasma.
7. A thin film of lithium is evaporatively deposited on the workpiece.
8. Adhesive tape (Kapton, or equivalent) is pressed onto the top of the workpiece, then pulled off. The lithium deposited on the photoresist-covered areas adheres more weakly than does the lithium deposited on the anode area, to such a degree that pulling off the tape removes all lithium from covering the photoresist while leaving all the lithium in the desired anode area.
9. The photoresist and the remaining parylene are removed by use of dry acetone and subsequent etching in oxygen plasma.

This work was done by Jay Whitacre and William West of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*

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