Unique Techniques for Printing High Efficiency Solar Cells

Never Stand Still | NewSouth Innovations

UNSW has developed new dielectric patterning techniques to replace photolithography. Less steps, less and cheaper chemicals for manufacturing high efficiency solar cells.

The Technology

UNSW holds the world record for the efficiency of single junction silicon solar cell. The record of 25.0% was achieved using photolithography, which is too expensive for large scale commercial implementation.

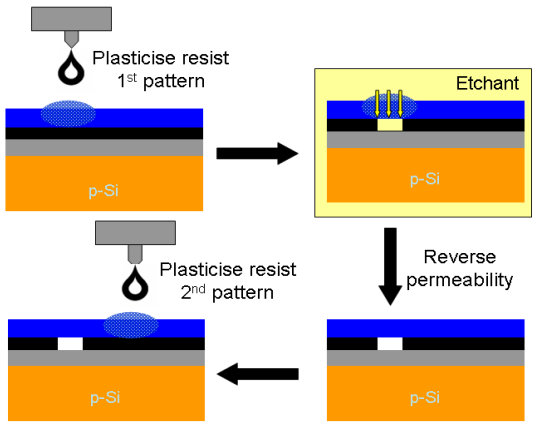
The UNSW patterning techniques, which use inkjet printing or aerosol jet printing, are cheaper than photolithography. They avoid the use of expensive masks and mask aligners.

Digital images represent the etching patterns, so they are easily prepared and changed. The etching pattern is printed to form openings in a dielectric layer of silicon dioxide or PECVD silicon nitride.

The 'resist' technique typically etches grooves of 45 µm width, and holes ~40 µm in diameter. A single resist layer can be used for multiple patterning processes.

How it works:

1. A resist layer is formed over the dielectric surface.
2. Patterned deposition of a plasticizer forms permeable regions in the resist layer.
3. Aqueous etchants then permeate through the patterned resist areas, and etch openings in the dielectric layer.



Process of patented 'resist' technique

The 'direct' technique, requires fewer steps and uses less and cheaper chemicals than photolithography.

How it works:

1. An acidic polymer layer is formed over the dielectric surface.
2. A pattern of non-corrosive fluoride ions is deposited onto the polymer
3. The fluoride ions react with the polymer to form hydrogen fluoride (HF) locally, which then etches the underlying dielectric layer.

Key Benefits

- Grooves narrow as 25 µm etched in a 75 nm thick PECVD silicon nitride layer using an aerosol jet printer
- Immersion etching step is not needed so therefore largely reduced quantities of toxic and corrosive etching fluid.
- Etched regions can be metal plated to form front metal contacts to the solar cell.
- Significant OH&S advantages by reducing operator training expenses and waste disposal issues.
- Other uses such as enhanced light capture into the cell by texturing the silicon surface with dielectric masks created using UNSW's dielectric patterning techniques.

Opportunity

Collaborative partnership with UNSW to introduce production of high efficiency solar cells for large scale commercial production.

For more information contact:
Daniel Gronowski
Business Development Manager
NewSouth Innovations
Ref 05_1910, 07_2081, 08_2191 & 09_2341
T: 02 9385 5594
E: d.gronowski@nsinnovations.com.au