Self-Aligned Fabrication of Silicon Heterojunction Interdigitated Back Contact Solar Cells
AzTE Case #M14-150P

Invention Description
Researchers at ASU have developed a self-aligned fabrication method for SHJ-IBC solar cells using stacked shadow masks and tunnel junctions to define areas where the different semiconductor materials are to be deposited. First, a master shadow mask is aligned and fixed to the rear of the solar cell before being overlaid with a second blocking shadow mask. The openings in the blocking mask are oversized compared to the openings in the master mask, simplifying alignment, and are arranged such that selected openings in the master mask are covered while the others remain uncovered. Doped layers of amorphous silicon (a-Si) form heterojunctions with the solar cell’s rear substrate, and after the blocking mask is removed, additional layers of a-Si and transparent conducting oxide are deposited to form base contacts and tunnel junctions. The masks can be made from simple metallic or ceramic material and only need to be aligned once, making them easy to apply. By using shadow masks this method saves time, money, and material, and prevents short circuiting and yield loss by ensuring no resist residue contaminates the heterojunctions.

Potential Applications
- Interdigitated Semiconductors
- SHJ-IBC Solar Cell Fabrication

Benefits and Advantages
- **Cost-Effective** – Shadow masks can be made from inexpensive sheet metal or ceramic material.
- **Efficient** – No lingering resist residue results in fewer product defects and higher manufacturing throughput.
- **Practical** – Shadow masks only need to be aligned once, making their application convenient and straightforward.