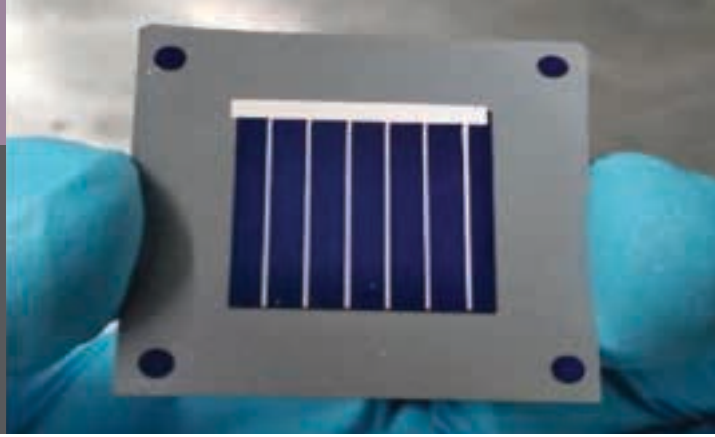
Fabrication of Crystalline Silicon-Based Heterojunction (SHJ) Thin-Film Solar Cells



Problem Statement: Most solar panels that we come across today constitute low efficiency but commercially viable polycrystalline silicon solar cells. These cells are increasingly being replaced by high-efficiency monocrystalline PERC solar cells. However, the fabrication of these cells involves several photolithography steps, due to which their cost is high. Furthermore, the processing temperature of such solar cells also demands high temperatures and hence more energy requirements. Again, c-Si, a material with an indirect bandgap, has a low absorption coefficient due to which thicker wafers are used, which affects the final cost of the cell. The researchers have addressed these drawbacks by fabricating low-cost solar cells.

Uniqueness of the Solution: The development of an industry-friendly process for fabricating high efficiency c-Si solar cells based on the heterojunction with intrinsic thin film (HIT) concept is demonstrated. All the amorphous silicon layers are deposited using the hot-wire chemical vapour deposition (HWCVD) technique. Employing low-temperature processing in developing heterojunction solar cells lowers not only the thermal budget but also material cost. Also, since cell fabrication does not incorporate sophisticated steps such as photolithography, its upscaling for industry integration will prove significantly easier.

Current Status of Technology: Single and double-sided SHJ solar cells have been fabricated (active area 2.3 cm2) and characterised in the laboratory under standard test conditions (STC) of 25°C operating temperature, 1.5 reference air mass.

Societal Impact: Availability of solar panels constituted by indigenously fabricated low-cost, high-efficiency cells increases application for rooftop energy generation, agricultural and irrigation demands, and transportation; it thereby improves the quality of living, especially in rural areas where a continuous supply of electricity is still a challenge.

Patent(s): Nil

Relevant Industries: Energy, Renewables.

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