Radial junction silicon nanowire mini-modules grown on FTO/glass substrates

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Recent progress in radial junction silicon nanowire solar cells (RJ SiNW) fabrication has led to an encouraging energy conversion efficiency (>9% [1]). Based on that, upscaling and extended compatibility with industrial processes are required. The first mini-module based on RJ SiNW solar cells has been fabricated. An open-circuit voltage of 3 V for cells connected in series using standard a-Si:H module fabrication process, including laser scribing technique, has been achieved for 4 cells of 5 x 0.4 cm^2 area each. The process starts with laser scribing of the SnO_2:F/glass substrates (5x5 cm^2) P1. Then, after introducing the samples inside the plasma-enhanced chemical vapor deposition (PECVD) reactor, Sn catalyst was produced by a hydrogen plasma treatment of the SnO_2:F substrates at temperature of 250 C (above the melting temperature of Sn). Afterwards, p-doped SiNWs were grown using plasma-assisted vapor-liquid-solid (VLS) growth [2]. Subsequently, the intrinsic a-Si:H layer was deposited with a thickness around 100 nm. For the finalization of the radial junctions, the samples were moved to another PECVD reactor where n-doped $\mu cSiO_x$ is deposited. After the SiNW radial junction solar cell deposition, the nanowire forest underwent a second laser scribing step (P2). Finally, an ITO top electrode was deposited using sputtering technique and ITO lines (P3) were obtained using a lift off technique. The most recent result on RJ SiNW solar mini-modules will be discussed as well as the future prospects for this technology and the challenges still laying ahead.

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