devices. Like any other technology, many methods for TF-Si solar cell production will emerge. The lift-off approaches for potentially high-efficiency single-crystal cells are very attractive. However, there are questions about the reliability of a technique that involves mechanical transfer from one substrate to the other. Likewise, reuse of the single crystal substrate is another issue.

The use of μc-Si seems to have a large potential because of being a true thin-film technology that can use some established thin-film processes. Furthermore, it can also derive benefits from ongoing R&D within the a-Si community. Because μc-Si is now used in traditional a-Si cells for junction formation, there is considerable added interest in studying deposition kinetics, phase transformation, and electronic and optical properties of μc-Si. To date, the performance of μc-Si is clearly limited by the grain size (controlling V_{OC} and FF). The highest efficiencies are obtained by using nip structure, which offers the advantage in achieving high currents. Higher voltages have been obtained using a mixture of a-Si and μc-Si phases. Because of the similarities in a-Si cells and μc-Si TF cells, there may be common features in module technology, too.

TF-Si solar cell technology will eventually compete with other thin-film technologies based on polycrystalline thin films of CdTe or CIGS ($Cu(UnGa)Se_2$). It may be argued that Si is a simpler material system and that its processing can be low cost compared to compound semiconductors. On the flip side, it is believed that GBs in poly thin films are "benign," making these material systems easy to process. Clearly, there is much more work to be done before such arguments can be resolved.

The TF-Si solar cell is an excellent solution to reduction in the use of Si and achievement of high efficiency at low cost. Many problems need to be solved before this technology can compete with existing solar cells, but the future looks very bright for TF-Si solar cells.

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