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Crystalline Silicon Solar Cells and Modules

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7.1 INTRODUCTION

Crystalline silicon solar cells and modules have dominated photovoltaic (PV) technology from the beginning. They constitute more than 85% of the PV market today, and although their decline in favor of other technologies has been announced a number of times, they presumably will retain their leading role for a time, at least for the next decade.

One of the reasons for crystalline silicon to be dominant in photovoltaics is the fact that microelectronics has developed silicon technology greatly. On the one hand, not only has the PV community benefited from the accumulated knowledge but also silicon feedstock and second-hand equipment have been acquired at reasonable prices. On the other hand, Microelectronics has taken advantage of some innovations and developments proposed in Photovoltaics.

For several decades, the terrestrial PV market has been dominated by *p*-type Czochralski silicon substrates. Continuous improvements in performance, yields and reliability have allowed an important cost reduction and the subsequent expansion of the PV market. Because of the lower cost of mc-Si wafers, multicrystalline (MC) silicon cells emerged in the 1980s as an alternative to single-crystal ones. However, their lower quality precluded the achievement of similar efficiencies to those of Cz, so that the figure of merit \$ W^{-1} has been quite similar for both technologies over a long time (see Table 7.1).

Deeper understanding of the physics and optics of the mc-Si material led to improved device design, which allowed a wider spread of the technology. A combination

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