Silicon Nanotexturing and Ion-Bombardment Energy

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The creation of a "Black-Silicon" surface has remained a tempting route to maximize absorption and thus efficiency for crystalline silicon PV. However, the creation of defects due to this process is a major point to be addressed. In this work on nanotextured samples, we study how both the increase of the surface area and the creation of defects due to the ion bombardment induced much higher effective SRV values (between 40 and 800 cm/s for samples with an effective reflectance below 5%).

The contribution of surface area enhancement has been successfully isolated, and a **positive link between the ion bombardment during the process and the final SRV of the textured surface** has been demonstrated: above around 85 eV, increasing the ion bombardment energy by 40 eV leads to a threefold rise in local SRV, therefore dramatically decreasing the electronic properties. An apparent acceptable trade-off has been identified with the following properties: an effective reflectance of 4.5% and an effective SRV around 38 cm/s. This sample was obtained by a 10 min process at relatively low ion bombardment energy (around 85 eV) and has a surface area enhancement factor around 3.3: as a consequence, the local SRV of this sample is close to the reference value (12cm/s, as compared to 7.4 cm/s).

Although further experiments would be required for confirmation, this result promisingly suggests that **passivation quality is not drastically limited by plasma nanotexturing if ion bombardment energy is kept below a threshold value of 85 eV**.