

## **An investigation of crystalline thin-film Si<sub>x</sub>/Ge<sub>1-x</sub>/Si solar cells**

### **Abstract**

Inability to achieve complete optical absorption in thin-film crystalline Si (TF c-Si) solar cells fundamentally limits efficiency. Therefore, materials with high absorption across the entire solar spectrum are highly desirable. In this study, several TF solar cell configurations based on Silicon Germanium (Si<sub>1-x</sub>Ge<sub>x</sub>) alloys have been investigated. With the help of PC1D software, TF c-Si solar cells with varying composition of Si<sub>1-x</sub>Ge<sub>x</sub> layers with x in the range of 4 % to 50 % have been modeled. In all cases, Si<sub>1-x</sub>Ge<sub>x</sub> solar cells performed better than c-Si TF solar cells; the optimized Ge concentration was determined to be 20%. For example, in case of 10- $\mu$ m thick TF solar cell, crystalline Si/Si<sub>1-x</sub>Ge<sub>x</sub> exhibits simulated efficiency of ~ 22 % in contrast with ~ 17 % for same thickness c-Si solar cell. Optimization of the alloy composition, doping concentration of the Si<sub>1-x</sub>Ge<sub>x</sub>, thickness of the alloy layer and placement of the layer in the cell structure will be reported at the conference.

**Keywords;** Silicon; Germanium; PC1D; IQE; Si<sub>x</sub>Ge<sub>1-x</sub> solar cells