Title

Crystalline Silicon PV Manufacturing, Metallization, and Environmental Sustainability

Abstract

Solar photovoltaic (PV) technology has proven its efficacy as a major energy source with >50 gigawatts (GW) global module production capacity resulting in >220 GW of deployed system power. The vast majority (>90%) of solar PV modules made today use crystalline silicon (c-Si) solar cells, with thin film technologies such as copper-indium-gallium-diselenide (CIGS) and cadmium telluride (CdTe) filling the balance. C-Si solar cell fabrication uses low cost processes like atmospheric diffusion and screen-printed (SP) metallization. However, as production capacity continues to rise, use of SP silver (Ag) for front side contact may lead to questionable long term industry sustainability. The precious metal status of Ag makes it a target for unpredictable market price fluctuations and world supply levels may not support c-Si PV deployment beyond the GW realm. In order to achieve terawatt (TW) levels of c-Si PV deployment, new materials and processes will need to be adopted which allow continued price reduction as well as long term production sustainability. One such material is copper (Cu). Though the use of Cu in c-Si PV poses many challenges, the International Technology Roadmap for PV (ITRPV) predicts rising adoption of Cu over the next decade. Incumbent (Ag) and next-gen (Cu) technologies will be compared and discussed in the context of increasing c-Si PV production and SUNY Polytechnic Institute’s capabilities and technology goals.