Defect Kinetics and Reliability of Silicon Cells and Modules

The conventional ribbon tabbed, glass-backsheet module configuration may start seeing a market decline as bifacial, all glass, frameless and high capacity panels start hitting the market and becoming mainstream. PV modules with novel configurations, like shingles and all metallic backsheet implement electrical conductive adhesive and advanced architectures to reduced interconnection losses. Canadian Solar is promoting glass-glass PV modules with 30-year performance warranty based mostly of its robust mechanical performance. These new configurations and assembly techniques translate into significantly different: (1) stress distribution on the cells, (2) water ingress profiles and (3) and sodium (PID inducing) diffusion profiles. While the community currently has a good understanding of the mechanisms and rates that drive failure on standard PV modules, new materials and processes open the door to new failure modes and degradation rates. We will present in this talk, novel module inspection methods to address water intake in modules as well as cell deflection and stress. We will also show our modeling efforts to build a comprehensive Defect-Device-Degradation Model that can be applied to assess new bill of materials and architectures.