Failure Modes Evaluation of PV Modules Under Different Climatic Regions in China

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PV modules are a very reliable source of electrical energy, field results indicate that the modules can fail or degrade in a number of ways. Before trying to eliminate or even reduce these degradation modes, a thorough understanding of their fail behavior and mechanism are required. China is the largest PV market in the world now and the climate in China in some where is harsh to PV module, such as Gobi area in China where have frequent sand storm and high UV radiation. So in this study, degradation modes are analyzed by measuring various PV module (c-Si solar cell, a-Si solar cell and CIGS solar cell) performance parameters including in-field test and lab test. Modules aged in field more than 30 years, 20 years and 10 years are collected from different regions such as moderate region, hot and dry region, cold and dry region, hot and humid region, Gobi and so on. NREL Visual inspection data collection method is used to collect visual inspection data and 14 sections are included in the checklist, such as junction box, grid bus, EVA, backsheet, and so on. All collected modules will be test again in lab. The test items include backsheet, silver gridline and bus-bar, EVA and solar cell by SEM, FTIR, Raman spectrometer etc. The durability of materials degradation and properties under different climatic regions will also be analyzed. This is the first time for China to map the reliability of PV modules (installed in field more than 30 years, 20 years, and 10 years) under different climatic regions and analyze the key fail factors under different climatic regions to optimize the material and process for manufacturing PV module in future.

Key words: Durability, Fail factor, PV modules, Climatic regions

Figure: pictures of PV module failures