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Development and Validation of Dye-sensitized Solar Cell Finite Element Model for Sealing Failure Investigation

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Dye-sensitized solar cells (DSC) have attracted many interests as one of the next generation solar cells. They have many relative advantages such as simple production process, cost-effective efficiency, using environmentally sustainable materials, wide range of color possible, semi-transparency, and working in cloudy weather and low-light conditions. DSCs are also considered for an important player in building-integrated photovoltaic (BIPV) applications.

Large-scaled DSC modules are recently developed for BIPV applications. In the modules, two glasses with electrodes and dye are joined for electrolyte and sealed together to prevent the leakage of electrolyte. Tests of the module in damp-heated environments expose several symptoms of electrolyte leakage through sealing failure. A finite element model is developed for the DSC module to investigate the possibility of the sealing failure from the different thermal expansions. The accuracy of the model is validated by experimenting the deformation patterns of the module in high temperature and comparing with the model results. Finally, the sensitivity of the width of sealing is studied and optimal configuration is suggested for preventing the sealing failure of DSC.