

Laser assisted dye-sensitized solar cell sealing: From small to large cells areas

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Abstract

Dye sensitized solar cells (DSCs) modules are an emergent photovoltaic technology but still present some weaknesses in terms of long-term stability: sealing is presently the Achilles' heel of DSCs, which is currently preventing their commercialization. Thermoplastic sealants are normally used to bond the two glass substrates of a DSC. However, these thermoplastic sealants, such as Surlyn®, are permeable towards ambient water vapor, UV sensitive, and they cannot be used above 60 °C. Laser assisted glass-frit sealing is a very interesting alternative sealing technique as it has been demonstrated on microelectromechanical systems assembly. For these applications, the laser is shot around the sealing perimeter several times in a loop pattern. Nevertheless, for sealing large areas without heating the samples, this method cannot be applied since the laser loop takes more than 1 s, which is too long for an effective low-temperature glass-frit sealing. At present, work is described a laser assisted sealing technique that is independent of the sealing border format. This technique is applied to several cells and modules of different shapes and sizes. The technique is suitable for DSCs manufacture and can be implemented in an inline production plant. For the same cell format, efficiencies of the glass-sealed and conventional sealing were compared. Stability studies were also presented to evidence the effectiveness of the hermetic sealing obtained with the newly developed sealing process of DSCs devices.