Laser assisted glass-glass encapsulation for perovskite solar cells

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Perovskite solar cells (PSC) have demonstrated a great potential in the solar energy field. Significant achievements have been reached with the use of new photoactive materials and new deposition methods. The highest power conversion efficiency reported to date certified by the National Renewable Energy Laboratory (NREL) of 20.1 % was obtained by the Korea Research Institute of Chemical Technology (KRICT) [1]. However, these devices are highly sensitive to atmospheric humidity and oxygen, which makes them unstable for long-term outdoor applications. Even though the stability of PSCs may be improved through the addition of blocking layers on top of the device or replacing air sensitive components with more stable materials [2, 3], the successful commercialization of PSC depends on a leak free and stable encapsulation process. To address this challenge a laser-assisted glass frit sealing technique was developed. Since the laser strikes only on the frit line, a couple of millimeters away from the frit the temperature remains unchanged; temperature sensitive components printed 2 mm away from the sealing line are then protected.

This work discloses for the first time a hermetic glass to glass laser-assisted encapsulation solution, which passed more stringent industrial encapsulation standards pertaining to helium leak rates, mechanical strength, and photovoltaic accreditation. Moreover, this encapsulation process was successfully applied to large area devices, proving that the sealing can be adapted to any device dimensions to bring stable PSCs to the photovoltaic market.

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