Advanced laser-based metallization proceses for PV and flex electronics

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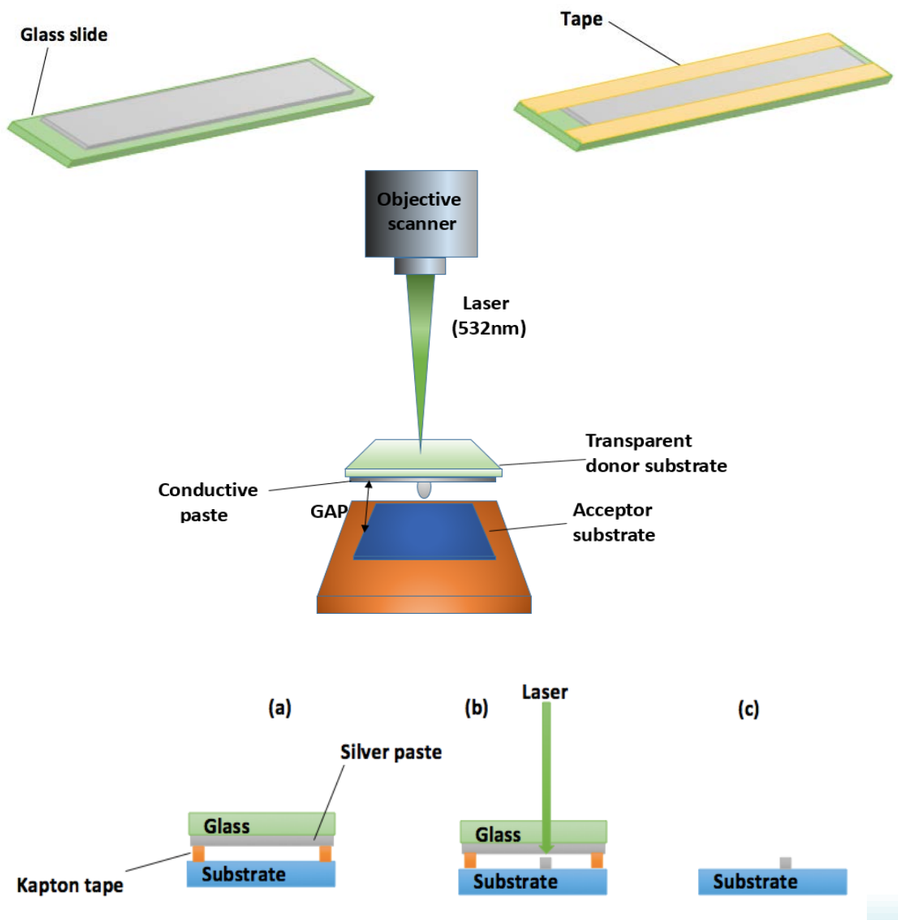
Abstract

Laser-induced forward transfer (LIFT) is a direct-write laser technique, capable of transferring a number of materials (solid materials, conductive inks, biomaterials, living cells,...) in high resolution patterns onto flexible substrates in planar geometry. Attractive features of LIFT process such as easy setup, high flexibility in choice of printing contents and cost-effectiveness even make it feasible for industrial printing of advanced materials. In this work, a commercial silver paste (DuPont PV17F) for solar cell metallization is printed by LIFT with a ns-pulsed laser (Explore Spectral-Physics).

LIFT method

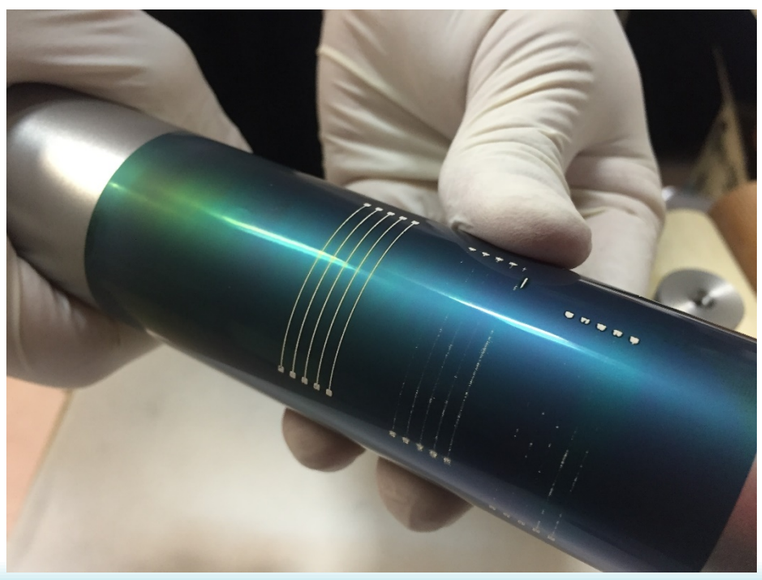
The silver paste is deposited onto microscope slides, which act as donor substrates, using a commercial coater. The donor substrate is then placed at a gap distance (~tens of microns) over an acceptor substrate, using Kapton tape.

LIFT donor preparation using Kapton® tapes



Experimental setup and scheme of the LIFT process

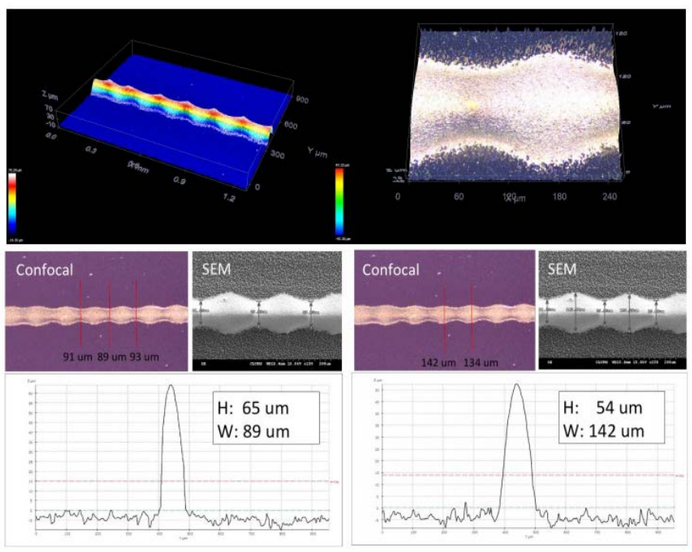
LIFT for flexible solar cells



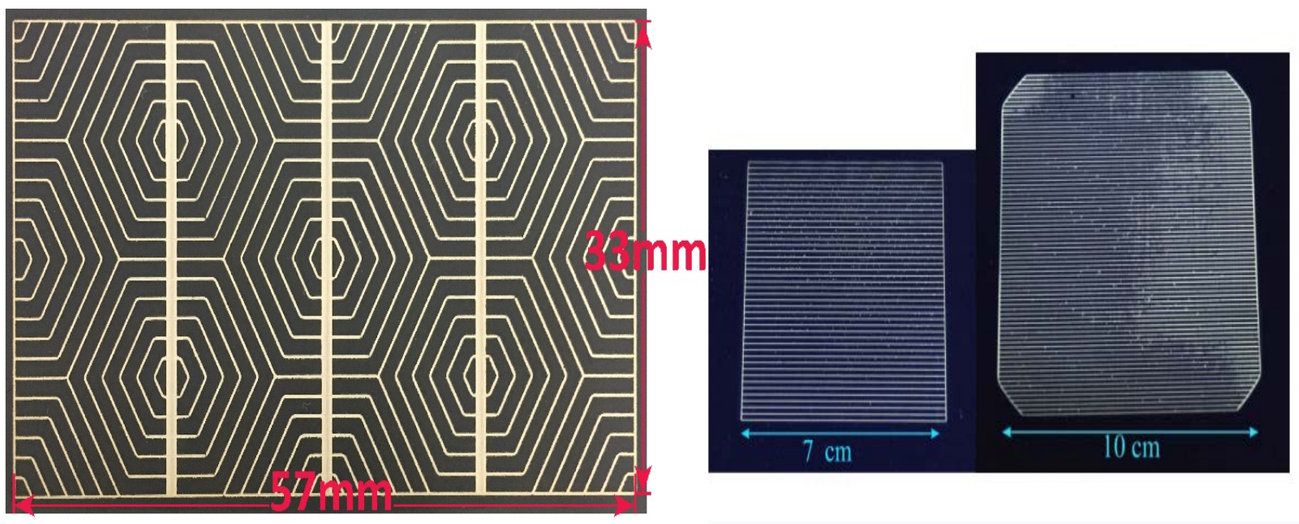
LIFT metallization lines

LIFT process parameters

Wavelength	532 nm
Pulse duration	14 ns
Frequency	20 kHz
Pulse energy	8-40 µJ
Spot size	25 µm
Silver paste thickness	30-80 µm
Gap	15-100 µm
Speed	0.05-2 m/s



LIFT silver paste line obtained with state-of-art laser machines available at industrial velocities (2 m/s).



Different large-area grid patterns printed by LIFT for solar cell metallization

Conclusions

- Metallization of solar cells using LIFT of commercial silver pastes has been achieved.
- A large volume of material per laser pulse (>300 pL) has been transferred using this approach.
- Long lines with large aspect ratio can be printed on the solar cell.
- Complex metallization patterns can be directly printed on the solar cell with large velocity (2 m/s).
- This approach can be applied to both to c-Si and flexible solar cells

ACKNOWLEDGEMENTS

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