Precision Excimer Laser Annealed Ga-doped ZnO Electron Transport Layer for Perovskite Solar Cells

Rui Xia,[ab] Guangyue Yin,[ac] Shimao Wang,[ad] Weiwei Dong,*[ad] Libing You,[a] Gang Meng,[ad] Xiaodong Fang,*[acd] Mohammad Khaja Nazeeruddin,[b] Zhaofu Fei,[b] Paul J. Dyson*[b]

[a]Anhui Provincial Key Laboratory of Photonic Devices and Materials, Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Hefei 230031, China

[b]Institut des Sciences et Ingénierie Chimiques, Ecole Polytechnique Fédérale de Lausanne (EPFL), CH-1015 Lausanne, Switzerland.

[c] University of Science and Technology of China, Hefei 230026, China.

[d]Key laboratory of photovoltaic and energy conservation materials, Chinese Academy of Sciences, Hefei 230031, China

E-mail: wwdong@aiofm.ac.cn (W. Dong), xdfang@aiofm.ac.cn (X. Fang), paul.dyson@epfl.ch

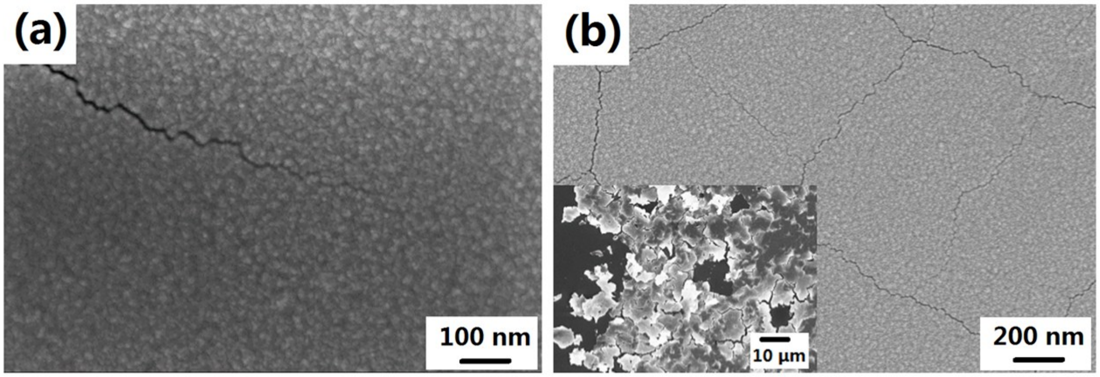

Fig S1 Surface SEM images of (a) ELA 90-30 and (b) ELA 105-1, the inset is ELA 105-20.

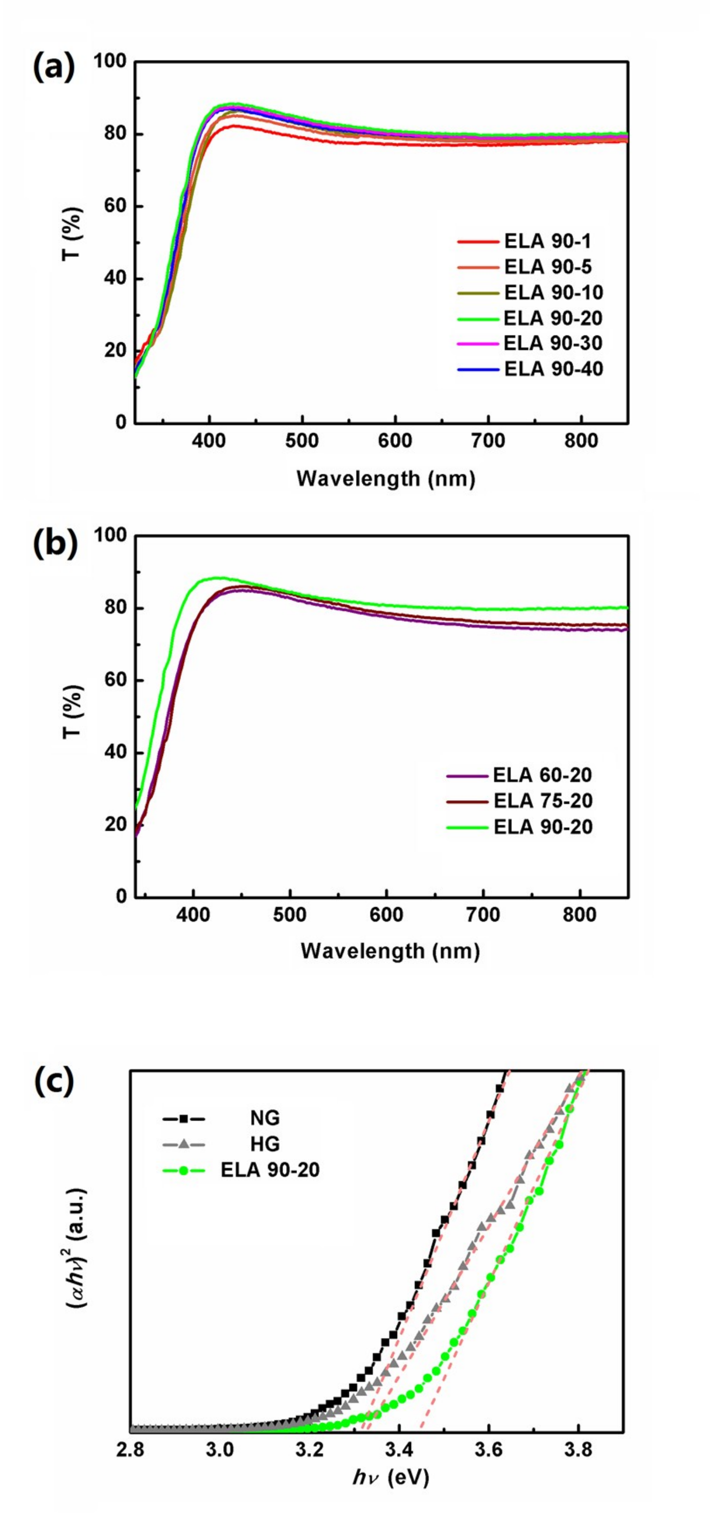

Fig S2 Transmittance spectra of GZO films with ELA treatment when (a) laser fluence is fixed at 90 mJ cm^{-2} and (b) pulse counts are fixed at 20. (c) $(\alpha h\nu)^2$ vs $h\nu$ plots of the GZO films with different treatments.

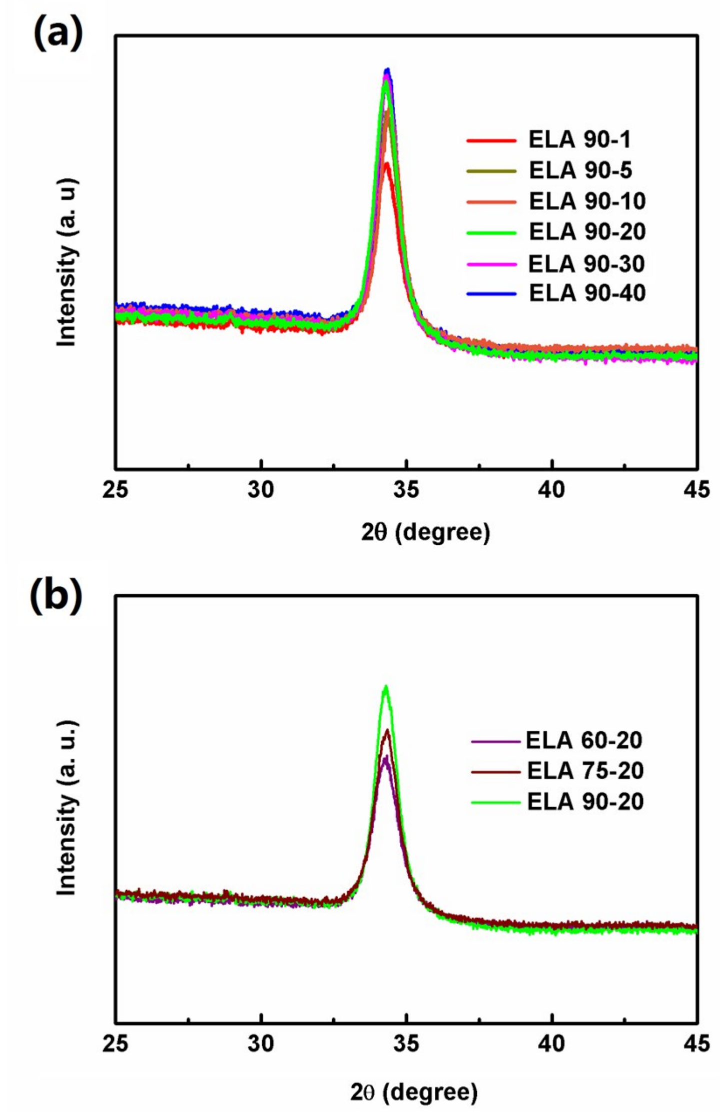

Fig S3 XRD patterns of GZO films with ELA treatment when (a) laser fluence is fixed at 90 mJ cm^{-2} and (b) pulse counts are fixed at 20.

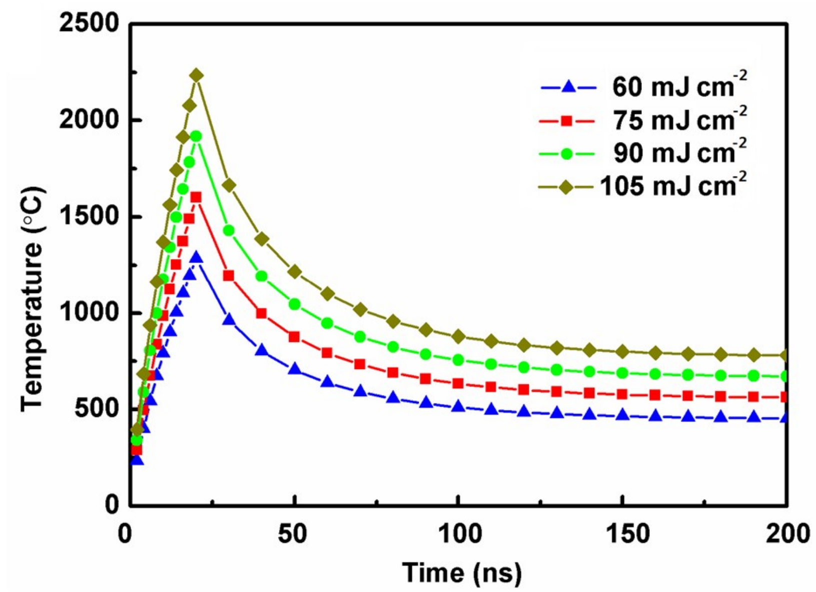

Fig. S4 Variation of the surface temperature with the time after loading 1 pulse with different fluence.

Table S1 Parameters used in ANSYS simulation process[1-3]. When t = 0, t = T_0 (27 °C), it is assumed that there is no heat loss on the surface of the films and the thickness of the sample is sufficient for the diffusion of heat inside[4].

Parameters	GZO	Glass
Density (kg/m^3)	5675	2400
Specific heat capacity J $(kg\ K)^{-1}$	552	837
Thermal conductivity ($W\ m^{-1}\ K^{-1}$)	23.4	1.1
Melt point (°C)	1975	800

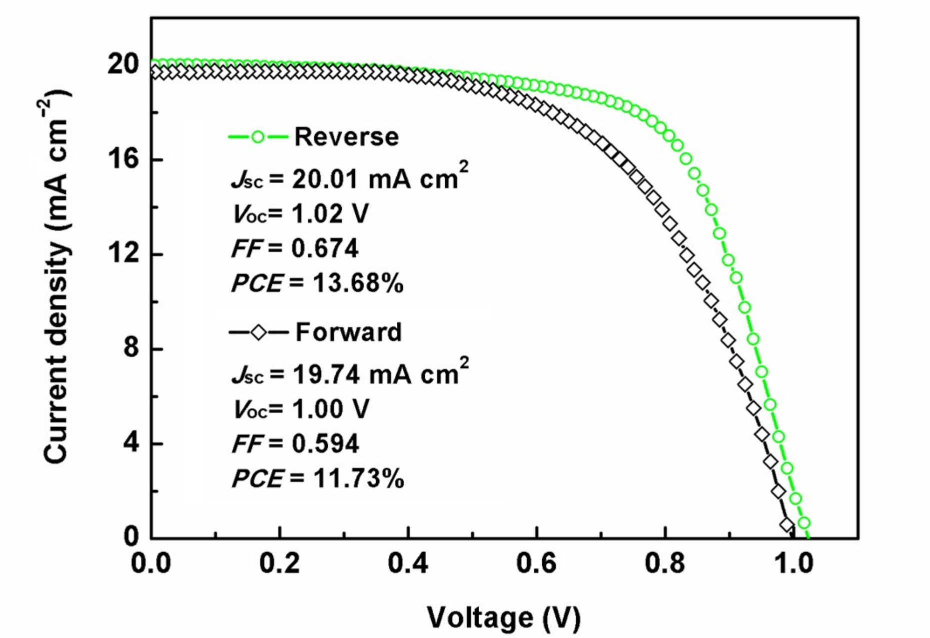

Fig. S5 Hysteresis analysis of the devices based on ELA 90-20 at a scan rate of 50 mV s^{-1}

Reference

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