Supporting Information

Prolonged Lifetime of perovskite solar cells using moisture blocked and temperature controlled encapsulation system comprising phase change material as a cooling agent

Nasibeh Mansour Rezaei Fumani[1], Farzaneh Arabpour Roghabadi [1, 2], Maryam Alidaei [2], Seyed Mojtaba Sadrameli[1*], Vahid Ahmadi[2*], Farhood Najafi[3]

[1] Faculty of Chemical Engineering, Tarbiat Modares University, Tehran, Iran

[2] Optoelectronic and Nanophotonic Research Group, Faculty of Electrical and Computer Engineering, Tarbiat Modares University, Tehran, Iran.

[3] Department of Resin and Additives, Institute for Color Science and Technology, Tehran, Iran.

Corresponding authors: Sadrameli@modares.ac.ir, V_ahmadi@modares.ac.ir

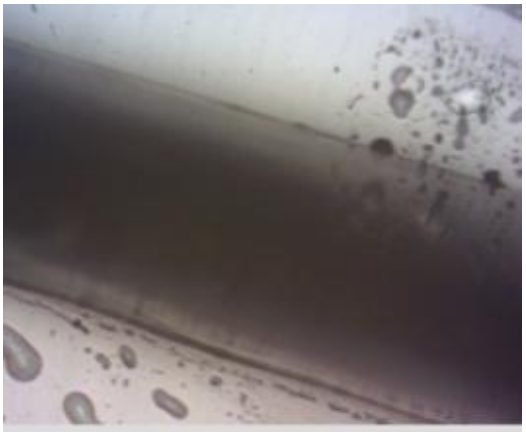


Figure S1 optical photo of the encapsulation system containing 1:1 ratio of PEG: resin.

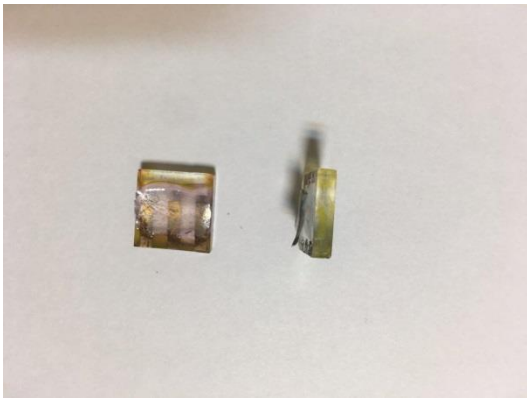


Figure S2 Photo of the damaged device encapsulated by 2:1, PEG: resin ratio system .

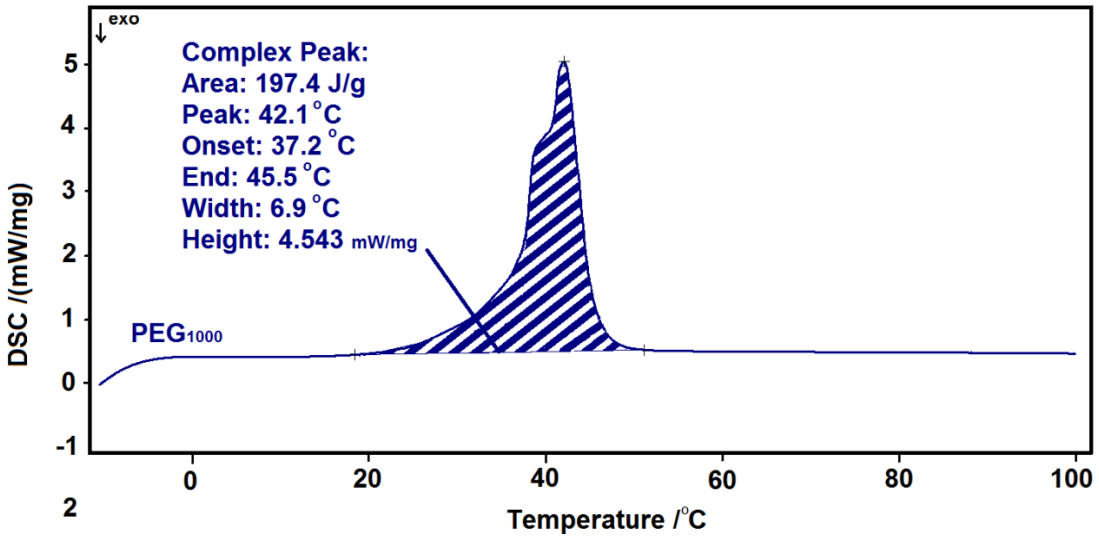


Figure S3 DSC curve of PEG1000 in heating cycle

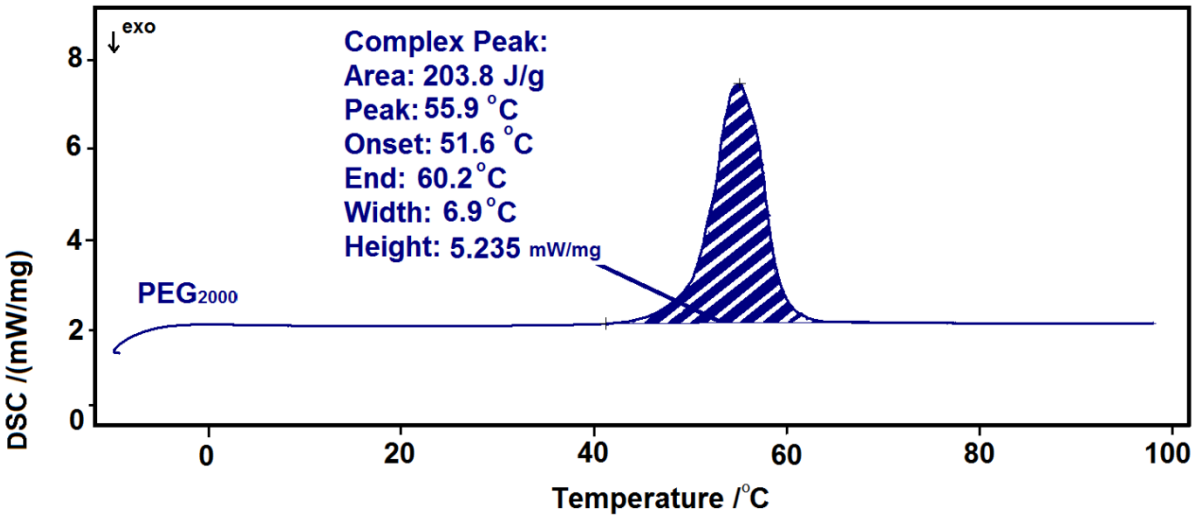


Figure S4 DSC curve of PEG2000 in heating cycle

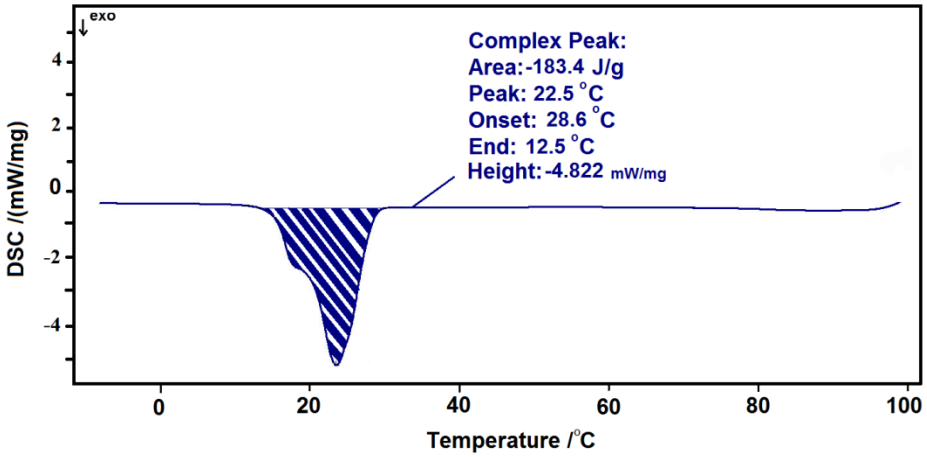
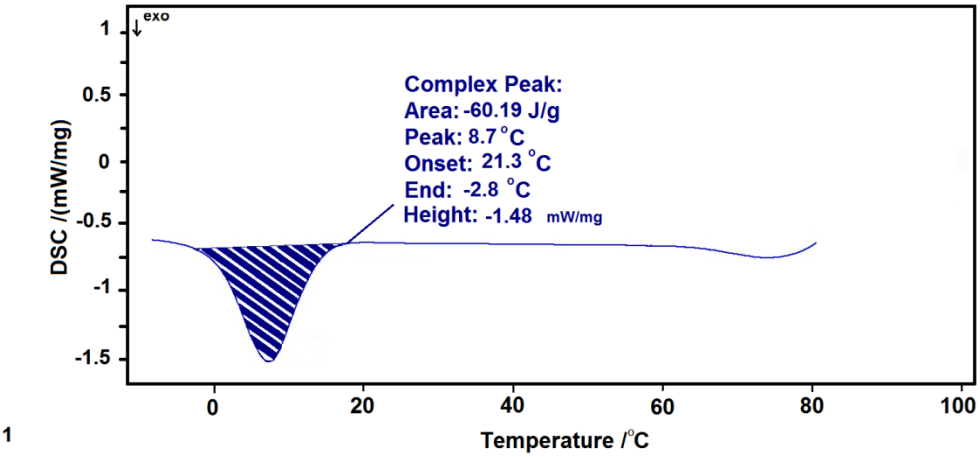


Figure S5 DSC curve of PEG 1000 in cooling cycle.



1

Figure S6 DSC curve of resin:PEG 1000 in cooling cycle.

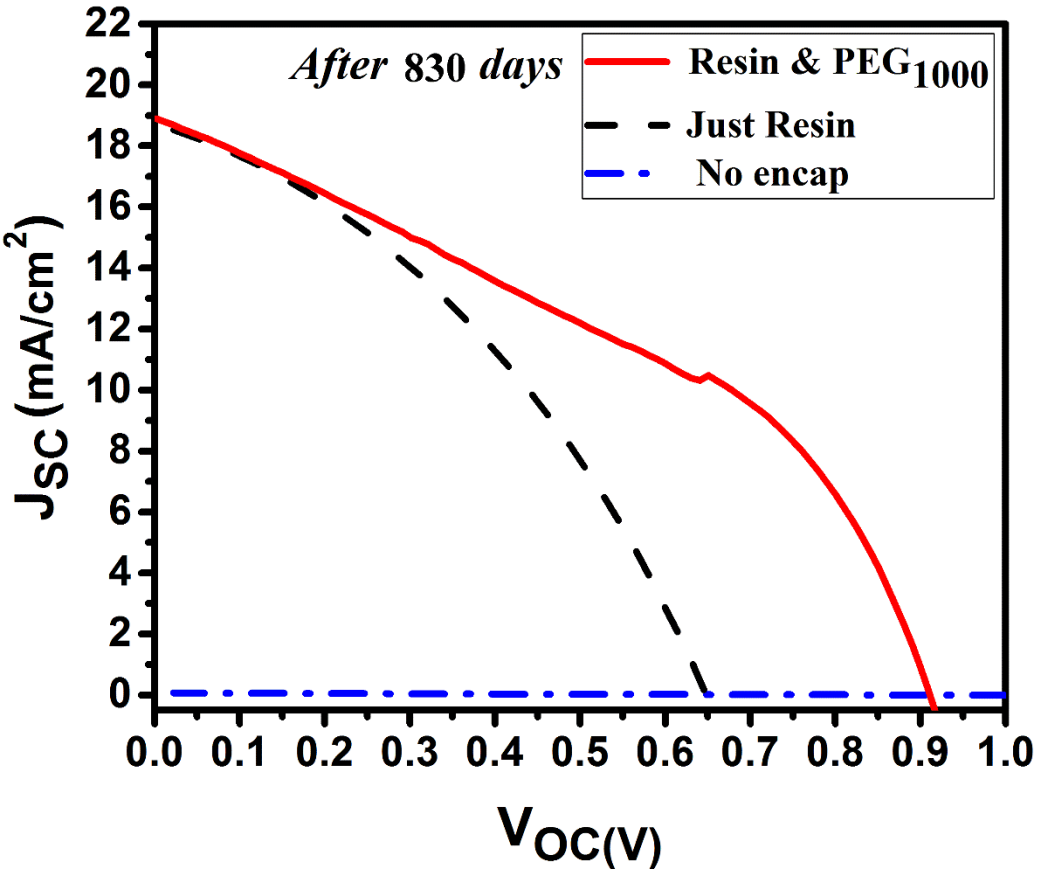


Figure S7 the J-V characteristics of the unencapsulated device, pure resin encapsulated device, and moisture blocked and temperature controlled encapsulated device at fresh condition and after 830 days storage.

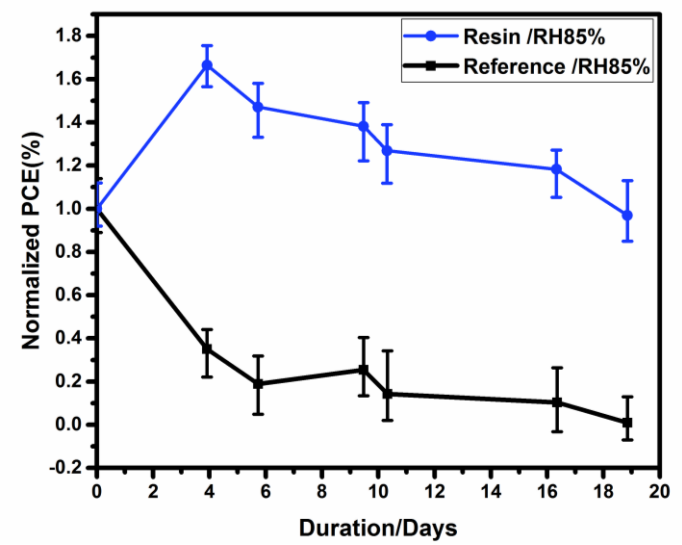


Figure S8 PCEs of Resin encapsulated and reference devices stored under RH of 85%.

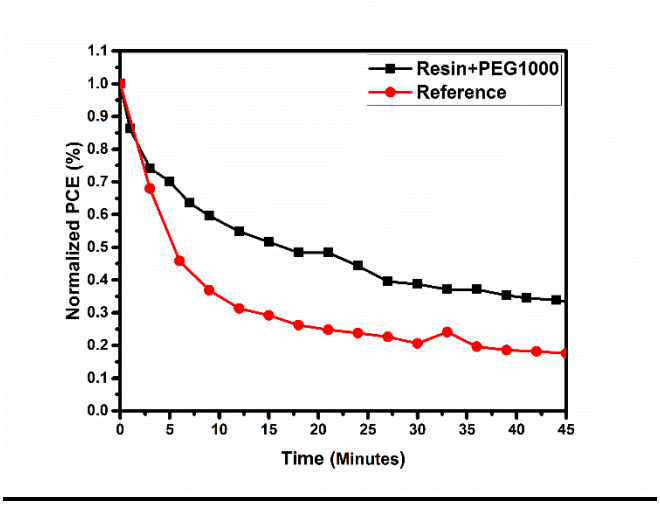


Figure S9 PCE of the reference device and encapsulated device by resin:PEG1000 under one sun illumination .

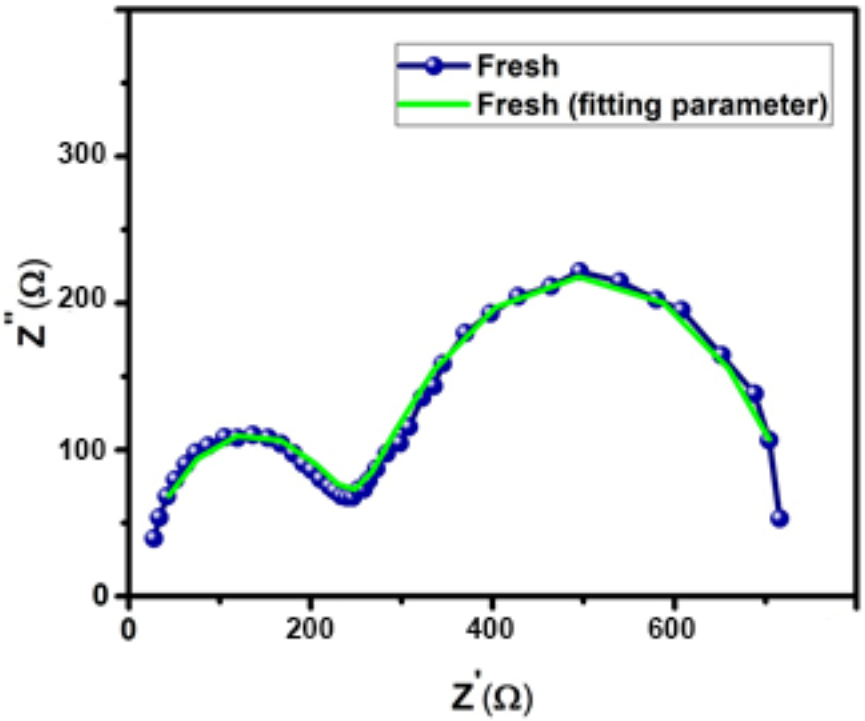


Figure S10 Impedance spectrum of the fresh device without encapsulation.

Table S1 Electrical properties of the fresh device without encapsulation.

Device	$R_s(\Omega)$	$R_1(\Omega)$	$R_2(\Omega)$	$C_1(F)$	$C_2(F)$
Fresh	15	190	450	1.9E-8	4.15E-6