

23

24 **Supplementary Table 2.** A moisture stability and mechanical stability summary of
 25 polymer assisted PSCs without encapsulation.

| ref | moisture stability | mechanical stability |
|-----------|---|--|
| [6] | | 75% of initial PCE after 2000 bending cycle at 5mm curvature radius |
| [7] | | 90% of initial PCE after 1000 bending cycle at 6mm curvature radius |
| [8] | | >90% of initial PCE after 2000 bending cycle at 3mm curvature radius |
| [9] | | 72% of initial PCE after 5000 bending cycle at 8mm curvature radius |
| [10] | 73% of initial PCE after 60h exposure to 80% RH | |
| [11] | 80% of initial PCE after 17d exposure to 50% RH under AM 1.5 illumination | |
| [12] | 91% of initial PCE after 4000h exposure to 50% RH | |
| [13] | 95% of initial PCE after 50d exposure to 30% RH | |
| [14] | >90% of initial PCE after 1000h exposure to 40% RH | >90% of initial PCE after 5000 bending cycle at 2.5mm curvature radius |
| [15] | >80% of initial PCE after 500h exposure to 30-60% RH | >90% of initial PCE after 1000 bending cycle at 10mm curvature radius |
| this work | 87% of initial PCE after 550h exposure to 50% RH | 72% of initial PCE after 2500 bending cycle at 6.25mm curvature radius |

26

27 **REFERENCES**

- 28 1. Guo Y, Cheng J, Liu L, Tan Z. Grains boundary networking interconnection
 29 design for robust flexible perovskite solar cell. *Mater Lett* 2021;129559. [doi:
 30 10.1016/j.matlet.2021.129559]

- 31 2. Yao Z, Qu D, Guo Y, Huang H. Grain boundary regulation of flexible perovskite
32 solar cells via a polymer alloy additive. *Org Electron* 2019:205-10. [doi:
33 10.1016/j.orgel.2019.04.029]
- 34 3. Wang Z, Zeng L, Zhang C et al. Rational Interface Design and Morphology
35 Control for Blade-Coating Efficient Flexible Perovskite Solar Cells with a
36 Record Fill Factor of 81%. *Adv Funct Mater* 2020;32:2001240. [doi:
37 10.1002/adfm.202001240]
- 38 4. Duan X, Li X, Tan L et al. Controlling Crystal Growth via an Autonomously
39 Longitudinal Scaffold for Planar Perovskite Solar Cells. *Adv Mater*
40 2020;26:2000617. [doi: 10.1002/adma.202000617]
- 41 5. Zhang H, Shi J, Zhu L et al. Polystyrene stabilized perovskite component, grain
42 and microstructure for improved efficiency and stability of planar solar cells.
43 *Nano Energy* 2018:383-92. [doi: 10.1016/j.nanoen.2017.11.024]
- 44 6. Kim M, Motti S G, Sorrentino R, Petrozza A. Enhanced solar cell stability by
45 hygroscopic polymer passivation of metal halide perovskite thin film. *Energy*
46 *Environ Sci* 2018;9:2609-19. [doi: 10.1039/C8EE01101J]
- 47 7. Yang J, Cao Q, He Z et al. The poly(styrene-co-acrylonitrile) polymer assisted
48 preparation of high-performance inverted perovskite solar cells with efficiency
49 exceeding 22%. *Nano Energy* 2021:105731. [doi:
50 10.1016/j.nanoen.2020.105731]
- 51 8. Gao X-X, Xue D-J, Gao D et al. High-Mobility Hydrophobic Conjugated
52 Polymer as Effective Interlayer for Air-Stable Efficient Perovskite Solar Cells.
53 *Solar RRL* 2019;1:1800232. [doi: 10.1002/solr.201800232]
- 54 9. Huang Z, Hu X, Liu C et al. Water-Resistant and Flexible Perovskite Solar Cells
55 via a Glued Interfacial Layer. *Adv Funct Mater* 2019;37:1902629. [doi:
56 10.1002/adfm.201902629]
- 57 10. Liu Z, Li S, Wang X et al. Interfacial engineering of front-contact with finely
58 tuned polymer interlayers for high-performance large-area flexible perovskite
59 solar cells. *Nano Energy* 2019:734-44. [doi: 10.1016/j.nanoen.2019.05.072]