Supporting Information for

Efficiency and stability enhancement of perovskite solar cells using reduced graphene oxide derived from earth-abundant natural graphite

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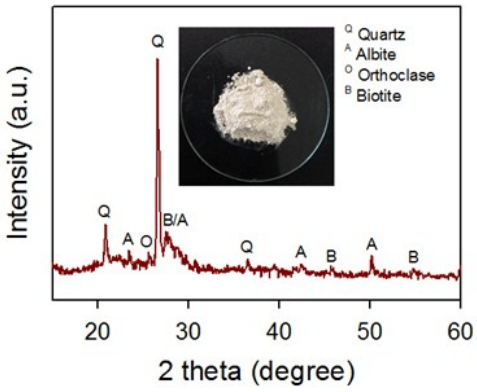

Fig. S1 XRD pattern of white residue obtained after chemical oxidation of raw (graphite) sample. Inset shows the digital photograph of the white powder used for the XRD.

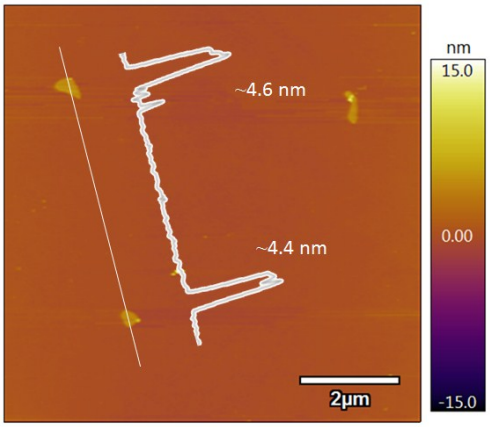

Fig. S2 AFM image of GO prepared from raw (graphite) sample.

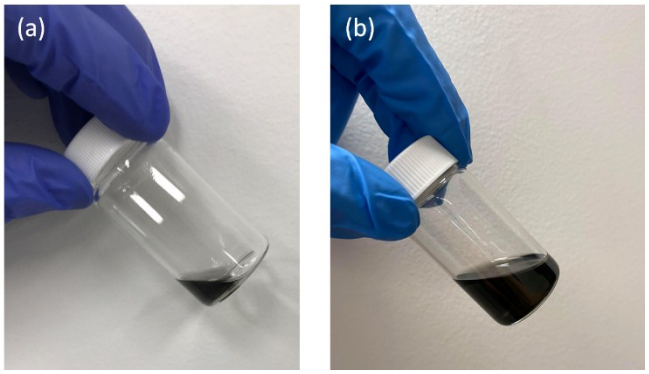

Fig. S3 Dispersion of the rGO in (a) dimethylformamide (DMF) solvent and (b) chlorobenzene (CBZ) solvent.

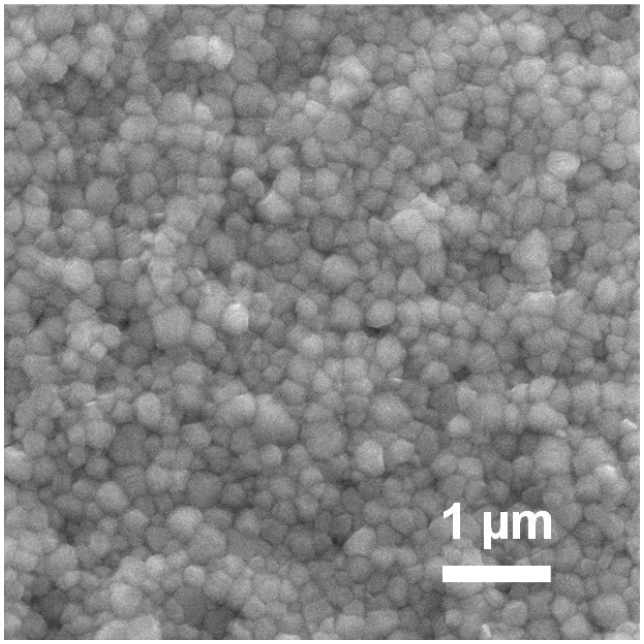

Fig. S4 SEM image of perovskite film.

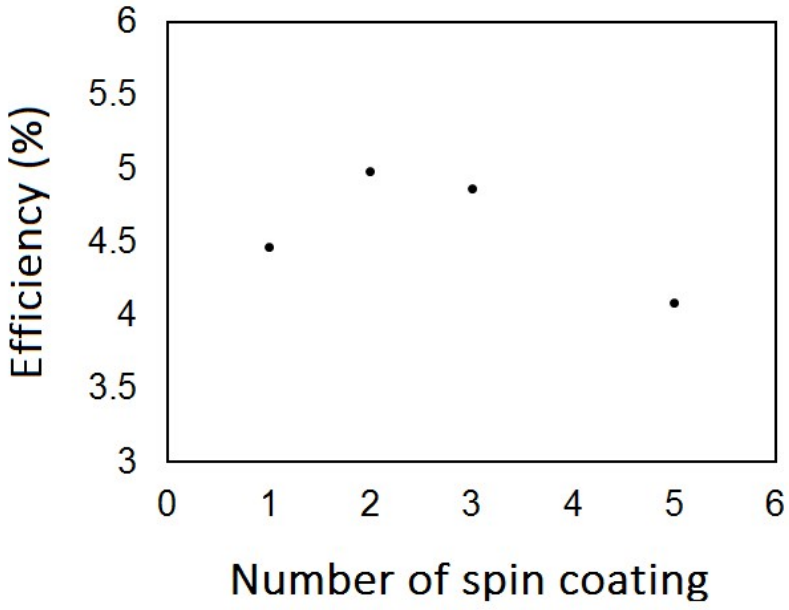

Fig. S5 Efficiencies of rGO HTM based PSCs. The devices were fabricated by spin coating rGO solutions on perovskite layer.

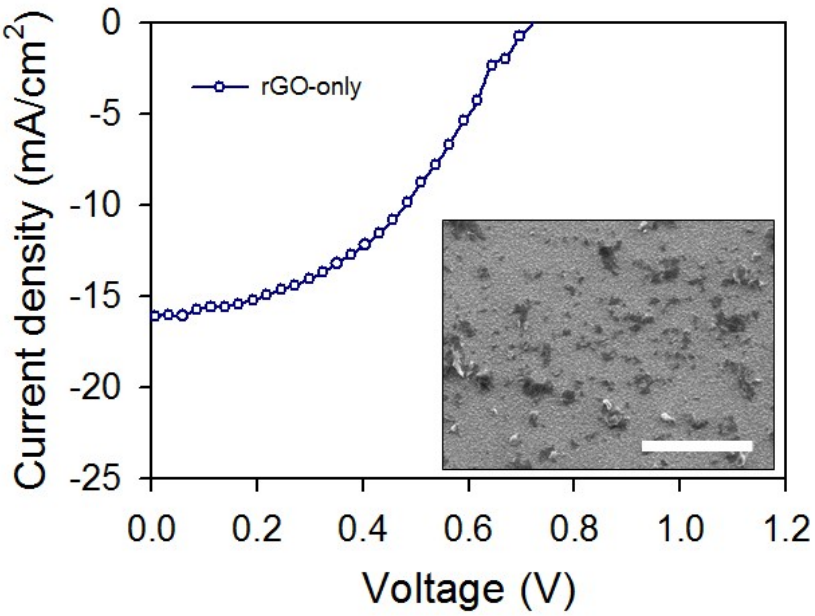

Fig. S6 J–V curve of the PSC fabricated with rGO-only HTM. Inset shows the SEM image of the rGO coated perovskite film, revealing a partial coverage of rGO using spin coating. The rGO was spin coated on the perovskite at 4000 rpm for 20 s using 1 mg mL^{-1} rGO dispersion in chlorobenzene. Scale bar: 50 µm.

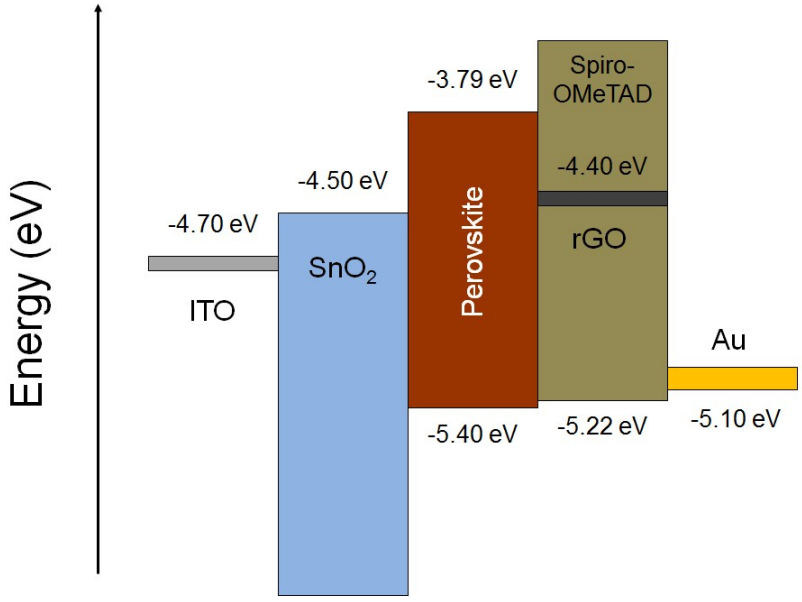

Fig. S7 Energy level diagram of PSC fabricated with rGO+Spiro-MeTAD.

Table S1. PV parameters of fresh and 500 h aged PSCs fabricated rGO-only, Spiro-OMeTAD and rGO+Spiro-OMeTAD as the HTM (data extracted from Fig. 5).

Device		**J_{sc} (mA cm^{-2})**	**V_{oc} (V)**	**FF**	**PCE (%)**
rGO-only	Fresh	16.20	0.72	0.43	4.98
	500 h	5.06	0.27	0.30	0.41
Spiro-OMeTAD	Fresh	22.56	1.10	0.70	17.26
	500 h	21.84	1.00	0.43	9.31
rGO+Spiro-OMeTAD	Fresh	23.05	1.11	0.71	18.13
	500 h	21.61	1.06	0.60	13.68