Supporting Information (SI)

Multifunctioning Graphene Oxide Capping Layer for Highly Efficient and Stable PEDOT:PSS-Silicon Hybrid Solar Cells

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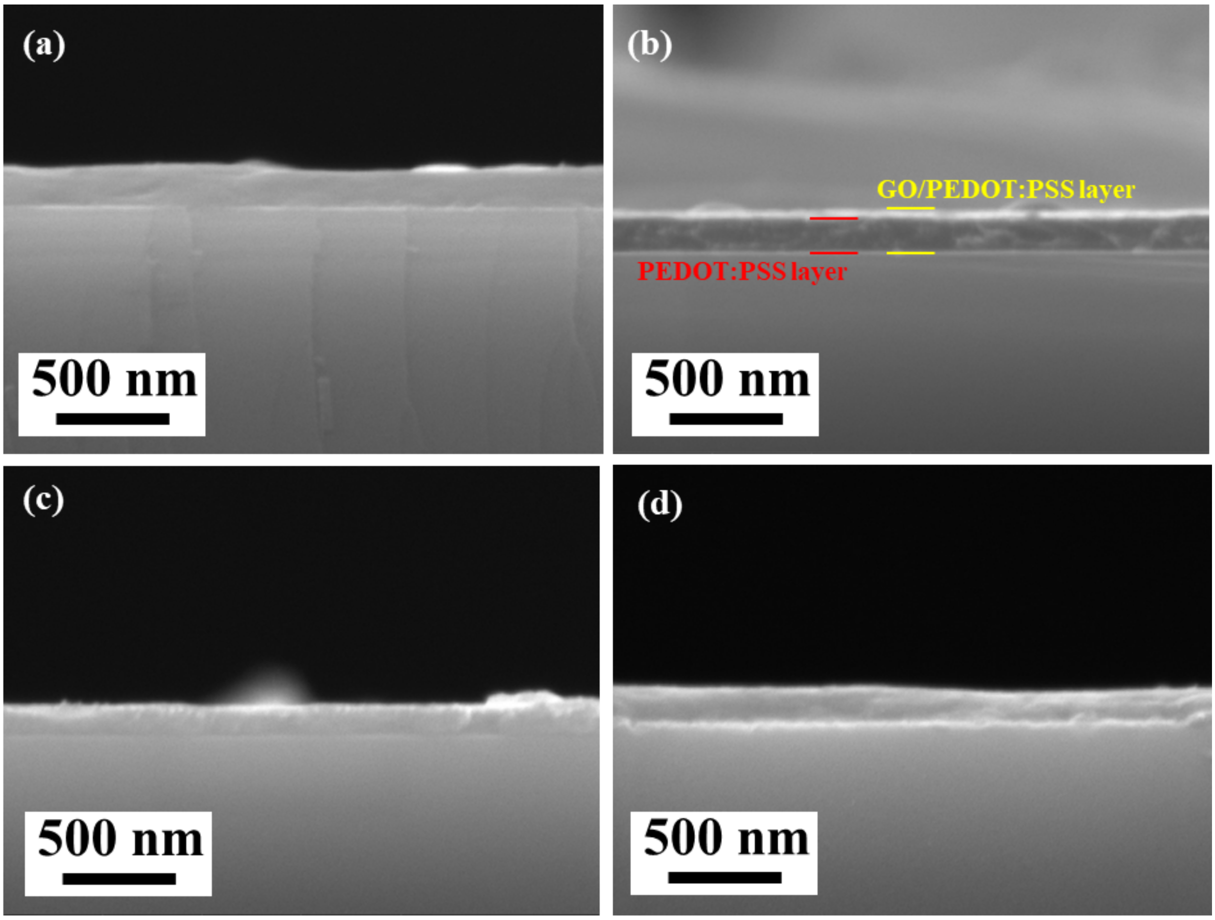

Figure S1. FESEM images for (a) only PEDOT:PSS layer and GO/PEDOT:PSS dual layer of, (b) PIGO2, (c) PIGO4, (d) PIGO6 over mirror polished Si wafers.

Table S1: Comparison of photovoltaic characteristics of the prior works for PEDOT:PSS/Si solar cells with the present work.

Device Structure and Dimensions	**Properties of Si wafers used**	**PEDOT:PSS and additive (as secondary dopants, surfactant, etc.)**	**Advanced structuring and processing**	**Remarks**	**Performance parameters of HHSCs**				**Reference No; Year**
					J_{sc} (mA/cm^2)	**V_{oc} (V)**	**FF (%)**	**PCE (%)**	
Au/PEDOT:PSS/textured n-Si/In:Ga (1.1×1.1 cm^2)	n-type (100) (ρ: 1-10 Ω-cm) (t: 500 ± 20 μm)	DMSO (5 wt%) Zonyl fluorosurfactant (0.15 wt%)	Glove box has been used	KOH based alkyl etching	24.58	0.515	40.43	5.17	1; 2022
Ag/PEDOT:PSS/GO-AuNPs/n-Si/Ti/Ag	-	PEDOT:PSS/GO-AuNPs			26.23	0.525	61	8.39	2 2022
Al/PEDOT:PSS/ AgNPs//SiNWs/ITO/Glass (2.25 cm^2)	n-type, (t: 530 μm) (ρ: 15 Ω-cm)	DMSO (5 wt%) Triton X: (1%)	Ag NPs on SiNWs		24.95	0.54	66.53	8.96	3; 2020
Ag/HQ-PEDOT:PSS/BQ/n-Si/LiF/Al (2×2 cm^2)	n-Si (100) (ρ: 1.7-2.3 Ω-cm) (t: 280 μm)	Hydroquinone (HQ)-Modified+ DMSO, Triton X-100	Benzoquinone (BQ)	Solution processed	27.7	0.618	61.8	10.6	4; 2022
Cr/Au/PEDOT:PSS/ VGNH/Al_2O_3 /n-Si/Ti/Pd/Ag (0.30 cm^2)	n-type (<100> P doped) (ρ: 1-5 Ω-cm) (t : 500 μm)	IPA for dilution, HNO_3 doping	graphene nano hills (VGNH)/Al_2O_3 passivation	Pyramid textured	34.99	0.560	56.01	10.97	5; 2020
Ag/GO/PEDOT:PSS/n-Si/In:Ga (1.5.×1.5 cm^2)	**Solar grade, as-cut Si wafers n-type (100) (CZ) (ρ: 1-3 Ω-cm) (t: 180±20 μm)**	**EG (7 wt%) + IPA**	**GO as capping layer over PEDOT:PSS**	**Pyramid texturing**	**29.79**	**0.560**	**69.90**	**11.66**	**Present work**
Ti/Ag/PEDOT:PSS/n c-Si/i a-Si:H /n a-Si:H/PEDOT:PSS/Al (1 × 1 cm^2)	n-type (100) (CZ) (ρ: 1-3 Ω-cm) t:150 μm	PEDOT:PSS DMSO (5 wt%) Triton X-100 (0.5%)	i-a-Si:H /n-a-Si:H	PECVD	29.7	0.620	65.8	12.1	6; 2016
Ag/PEDOT:PSS/Si/Ag	n-type, radial 〈100〉 ±	EG (5 wt %)	Annealing in		29.19	0.579	73.08	12.35	7;

(1×1cm^2)	0.5°, single-side polished (ρ: 2-4 Ω-cm) (t : 400 µm)	TX-100 (0.25 wt%)	muffle furnace at 120 ℃						2021
Ag/PEDOT:PSS/Si/Ag (0.5×0.5 cm^2)	n-Si, radial ⟨100⟩, polished single side, (ρ: 2-4 Ω-cm) (t : 500 µm)	EG (5 wt %) TX-100 (0.25 wt%)	TX-100: 0.25 magnetic stirring for 8 h,		30.81	0.560	71	12.38	8; 2021
Ag/PEDOT:PSS/Rubrene/n-Si/Ag (0.5 × 0.5cm^2)	n-Si (polished single-side, radial ⟨100⟩ (ρ: 2-4 Ω-cm) (t: 500 µm)	EG (5 wt %) TX-100 (0.25 wt%)	rubrene EG suspension interface		28.83	0.586	74.5	12.59	9; 2021
Ag/PMMA/Graphene/PEDOT:PSS/SiO_2/ Si/In-Ga (1.2 × 1.2 cm^2)	n-type (100) (ρ: 1-10 Ω-cm) (t: 500 µm) 300 nm thick oxide layer	(DMSO) (5 wt%) (IPA) Triton X-100 (1 wt%)	CH_3- terminated surface	Chlorination, methylation in glove box	30.63	0.580	73	13.01	10; 2022
Ag/ PEDOT:PSS-V_2O_5/n-Si/Al (0.8 cm^2)	n-type [100], (ρ: 0.05-0.10 Ω-cm) (t: 290 ± 10 µm)	PEDOT:PSS-V_2O_5 composite	glove box filled with nitrogen gas		32.80	0.652	70.98	15.17	11; 2023
AgNW/Ag grid/ PEDOT:PSS/ Siloxane/µT-Si/Siloxane/Ti/Ag (1 cm^2)	CZ c-Si Both side polished (ρ:1-5 Ω cm) t=250 µm	Methanol (78.5 wt%) EG (1.5 wt %)	Siloxane	Contact printing (70 ℃, 3h)	38.09	0.620	74.58	17.61	12; 2019

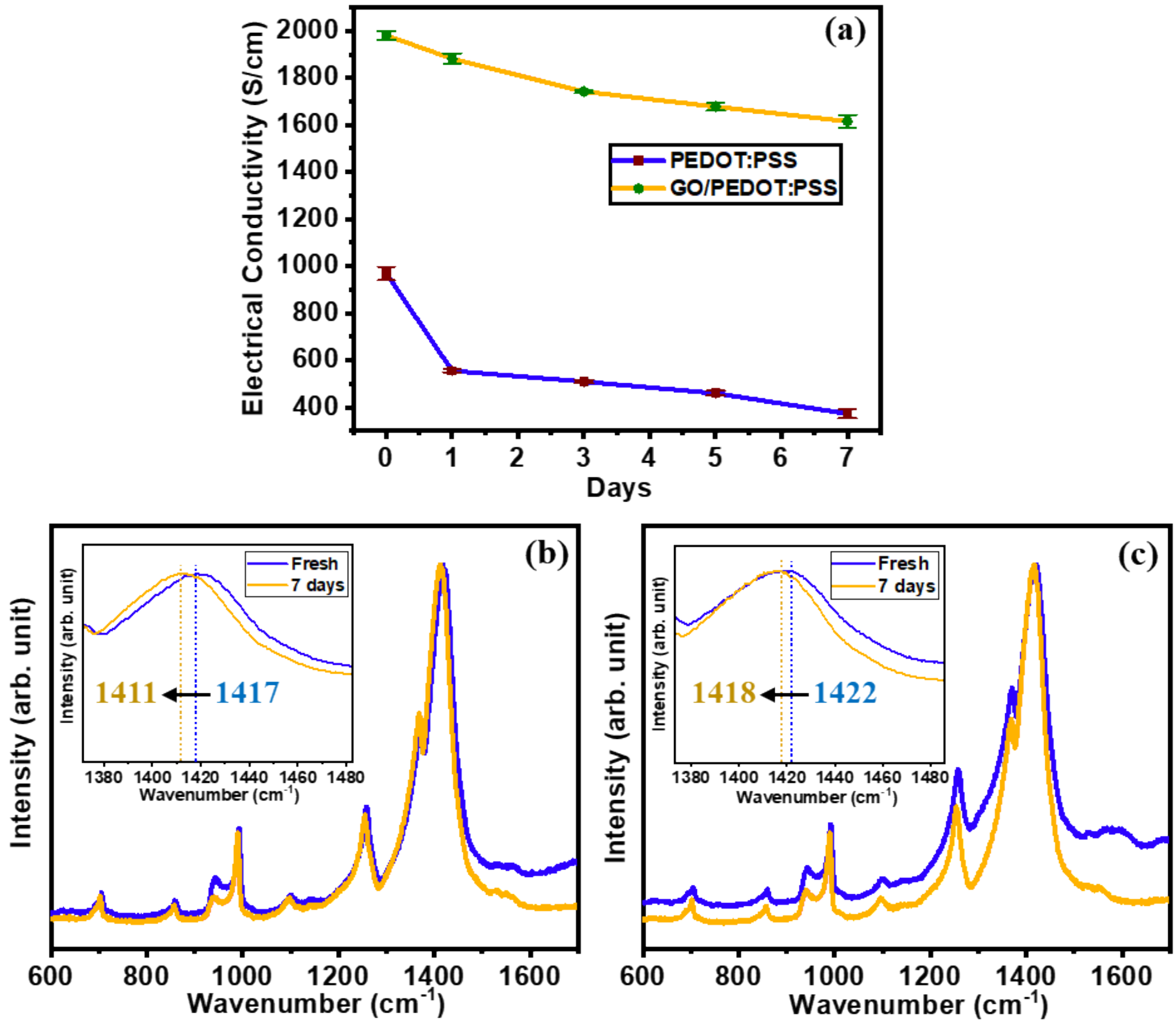

Figure S2. (a) Electrical conductivity and Raman spectroscopy results for the (b) PEDOT:PSS and, (c) GO/PEDOT:PSS layers over 7 days of aging time under atmospheric conditions.

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