

Supplementary Information for

**Optimizing Graphene Content in NiSe/Graphene Nanohybrid Counter
Electrode on Boosting Photovoltaic Performance of Dye-sensitized Solar Cells**

Vignesh Murugadoss,^{a,b} Jing Lin,^c Hu Liu,^d Xianmin Mai,^f

Tao Ding,^{e,*} Zhanhu Guo^{b,*}, Subramania Angaiah^{a,*}

^aElectro-Materials Research Laboratory, Centre for Nanoscience and Technology,
Pondicherry University, Puducherry - 605 014, India.

^bIntegrated Composites Laboratory (ICL),
Department of Chemical and Biomolecular Engineering,
University of Tennessee, Knoxville, TN 37996 USA

^cSchool of Chemistry and Chemical Engineering, Guangzhou University,
Guangzhou 510006, China

^dKey Laboratory of Materials Processing and Mold (Zhengzhou University), Ministry of
Education, National Engineering Research Center for Advanced Polymer Processing
Technology, Zhengzhou University, Zhengzhou, China

^eCollege of Chemistry and Chemical Engineering, Henan University, Kaifeng 475004, China

^fSchool of Urban Planning and Architecture, Southwest Minzu University, Chengdu 610041,
China

*Corresponding Author

E-mail: zguo10@utk.edu or nanomaterilas2000@gmail.com (Z. G.)
[Or a.subramania@gmail.com](mailto:a.subramania@gmail.com) (S. A.)

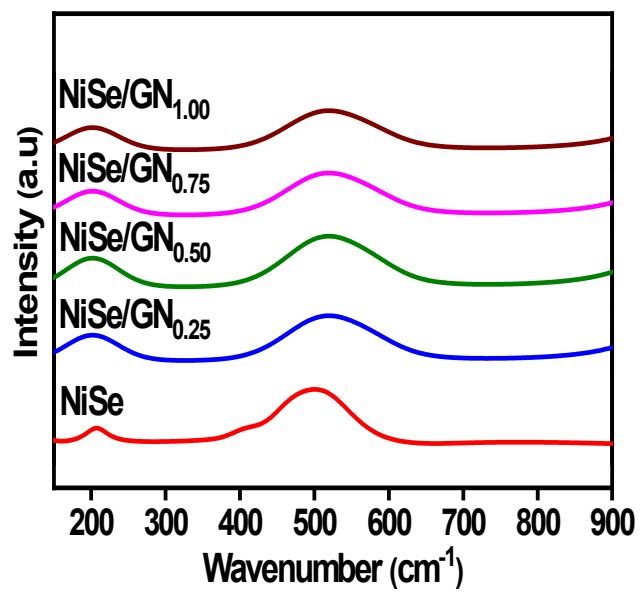


Fig. S1 Enlarged version of NiSe and NiSe/GN_x (x=0.25 to 1.00) nanohybrids in the region between 150 cm⁻¹ and 800 cm⁻¹.

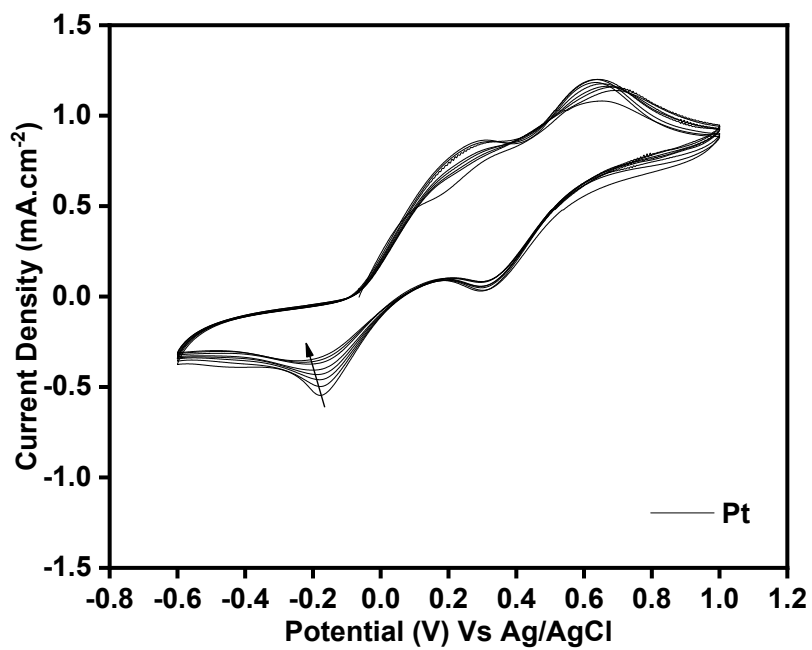


Fig. S2 CV curves of Pt at the scan rate of 50mV s⁻¹ up to 10 cycles.

Table S1 Statistical data for the photovoltaic parameters of DSSCs fabricated with platinum counter electrode.

DSSC	J_{sc} (mA/cm ²)	V_{oc} (V)	FF	η (%)
1	15.24	0.723	0.683	7.53
2	15.11	0.728	0.678	7.46
3	15.18	0.740	0.684	7.68
Average	15.177	0.7303	0.6817	7.5567
Deviation	0.0651	0.0087	0.0032	0.1124

Table S2 Statistical data for the photovoltaic parameters of DSSCs fabricated with NiSe counter electrode.

DSSC	J_{sc} (mA/cm ²)	V_{oc} (V)	FF	η (%)
1	14.34	0.752	0.660	7.12
2	14.12	0.761	0.669	7.18
3	14.05	0.748	0.669	7.03
Average	14.17	0.7537	0.666	7.11
Deviation	0.1513	0.0066	0.0052	0.0755

Table S3 Statistical data for the photovoltaic parameters of DSSCs fabricated with NiSe/GN_{0.50} electrode.

DSSC	J_{sc} (mA/cm ²)	V_{oc} (V)	FF	η (%)
1	16.73	0.751	0.687	8.62
2	16.53	0.739	0.686	8.38
3	16.67	0.743	0.679	8.41
Average	16.6433	0.74433	0.684	8.47
Deviation	0.1026	0.0061	0.0044	0.1308