Electronic Supplementary Material (ESI) for RSC Advances

Supporting Information

Role of Deoxy Group on the High Concentration of Graphene in Surfactant / Water Media

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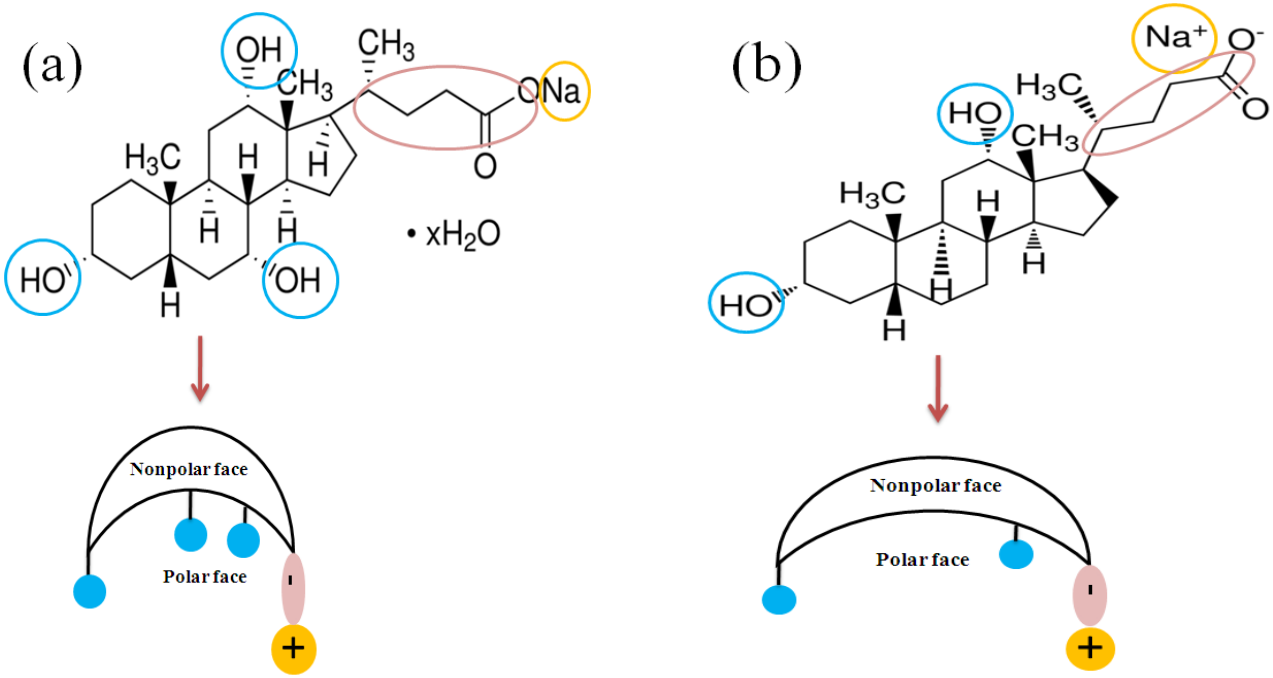


Figure (S1): Chemical and Schematic structure of sodium cholate and sodium deoxycholate bile salt surfactants

Zeta Potential

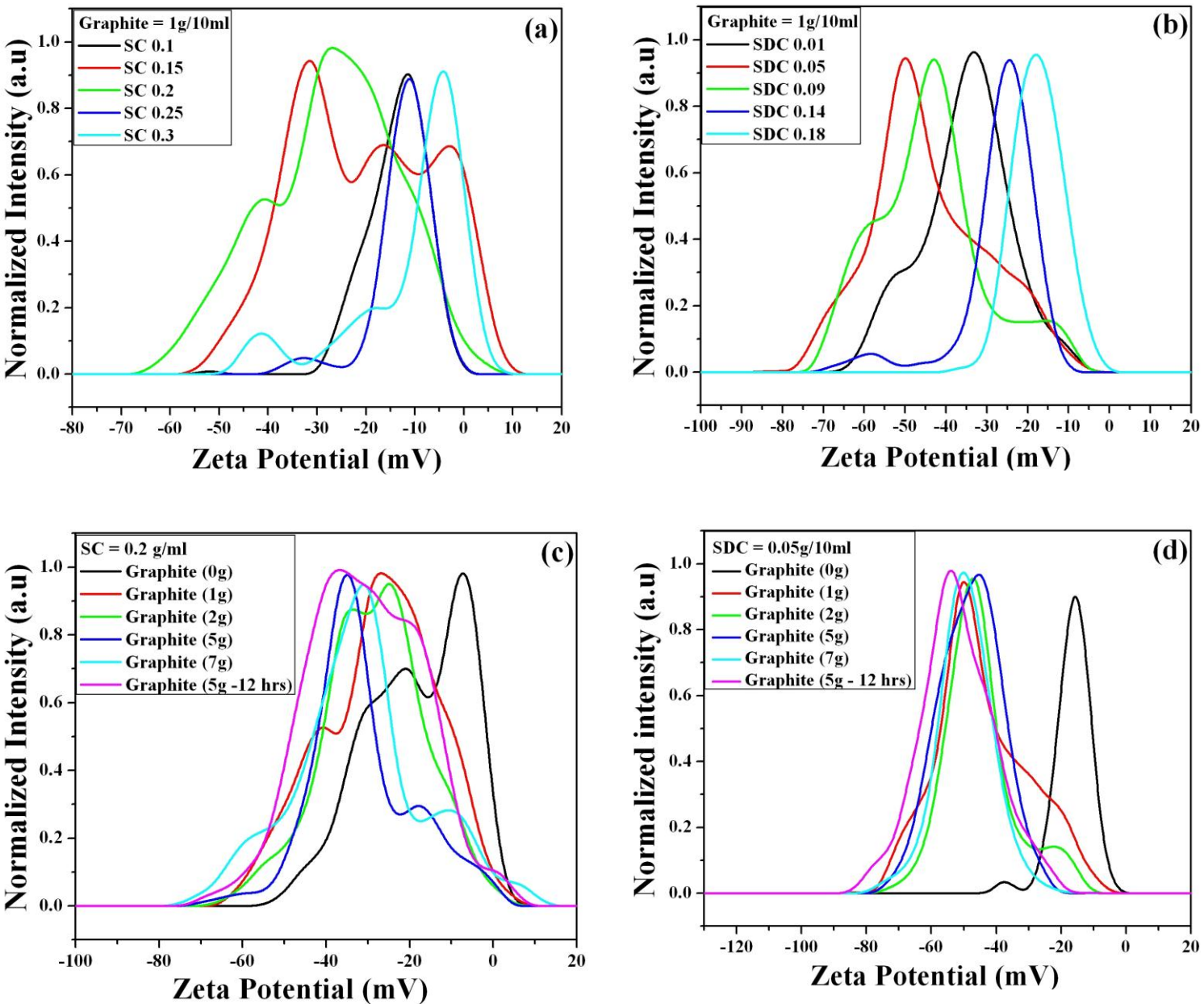


Figure (S2) : Zeta potential distribution curves for graphene dispersions prepared in different concentrations of Surfactants at constant initial graphite (C_G = 1g/10mL) concentration as (a) C_{SCi} (i = 0.1 to 0.3g/10mL) and (b) C_{SDCj} (j = 0.01 to 0.18g/10mL); (c) and (d) for graphene dispersions prepared in various initial graphite concentrations at constant surfactant concentrations (c) C_{SC} = 0.2g and (d) C_{SDC} = 0.05g for initial C_{Gk} = 1 to 7g/10mL. Here, all samples were diluted equally in the ratio of (1:10) mL in water.

FT-IR Study

There is an unusual hump evolved at 2365 cm^{-1} in both which is mostly observed in reduced graphene oxides. Vibration of "aromatic" structure of graphite can be observed in the range of 1550 to 1600 cm^{-1}.

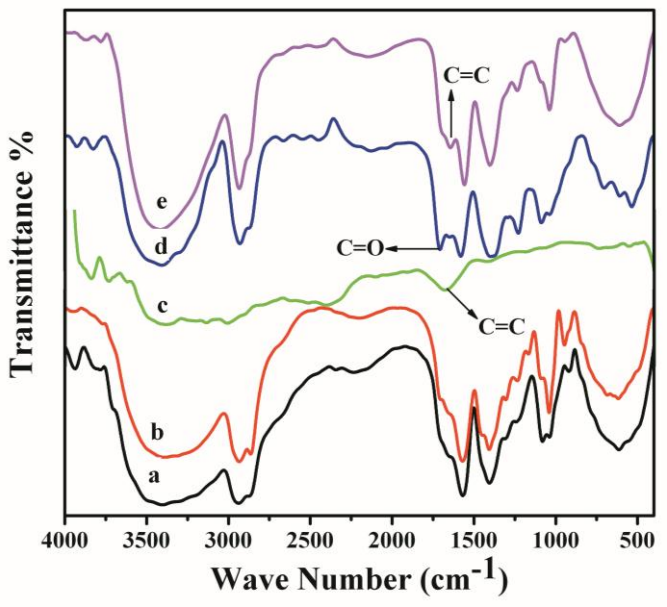


Figure (S3). FT-IR spectra of (a) Pure SC (b) Pure SDC (c) Graphite (d) SC-G and (e) SDC-G powders.

Table (S1). D, G and D' band positions and I_D/I_G

Sample	D (cm^{-1})	G (cm^{-1})	D' (cm^{-1})	I_D/I_G
Graphite	1329	1572	1615	0.3125
SC-G Powder	1334	1576	1610	0.7558
SDC-G Powder	1328	1568	1576	0.5172
SC-G (12 hr) film	1329	1581	1615	1.4000
SDC-G (12 hr) film	1329	1583	1617	2.0070

TABLE (S2). Deconvolute peaks of 2D band with corresponding FWHM and I_{2D}/I_G ratio

Sample	$2D_1$ (cm^{-1})	FWHM (cm^{-1})	$2D_2$ (cm^{-1})	FWHM (cm^{-1})	$2D_3$ (cm^{-1})	FWHM (cm^{-1})	$2D_4$ (cm^{-1})	FWHM (cm^{-1})	I_{2D}/I_G
Graphite	2578	11	2606	22	2638	45	2671	49	0.4375
SC-G Powder	2586	36	2615	11	2641	40	2665	48	0.3488
SDC-G Powder	2582	13	2613	55	2646	42	2676	42	0.3201
SC-G (12hr) film	2599	89	2626	27	2652	39	2674	43	0.4500
SDC-G (12hr) film	-	-	2629	49	2655	35	2679	31	0.4578

Optical images

Optical Microscopic images were taken to analyze the dispersion quality of the higher concentration graphene dispersion for both SC and SDC surfactants. To record optical microscopic image, the samples were prepared by drop-casting (0.2mL) the SC-G and SDC-G dispersions on glass substrates. The samples were dried at 80˚C for 1hr to evaporate the solvent. **Figure (S4)** shows the optical images of SC-G and SDC-G higher concentration dispersion coating. Black paint like coating is formed on glass substrate for SDC-G solution without any other sedimentation or particles. The boundary of the sample and glass substrate can be differentiated. Whereas, in SC-G coated substrate has the expelled Sodium cholate molecules which is present as spherical micelles out of the graphene surfaces and also agglomerated on substrate.

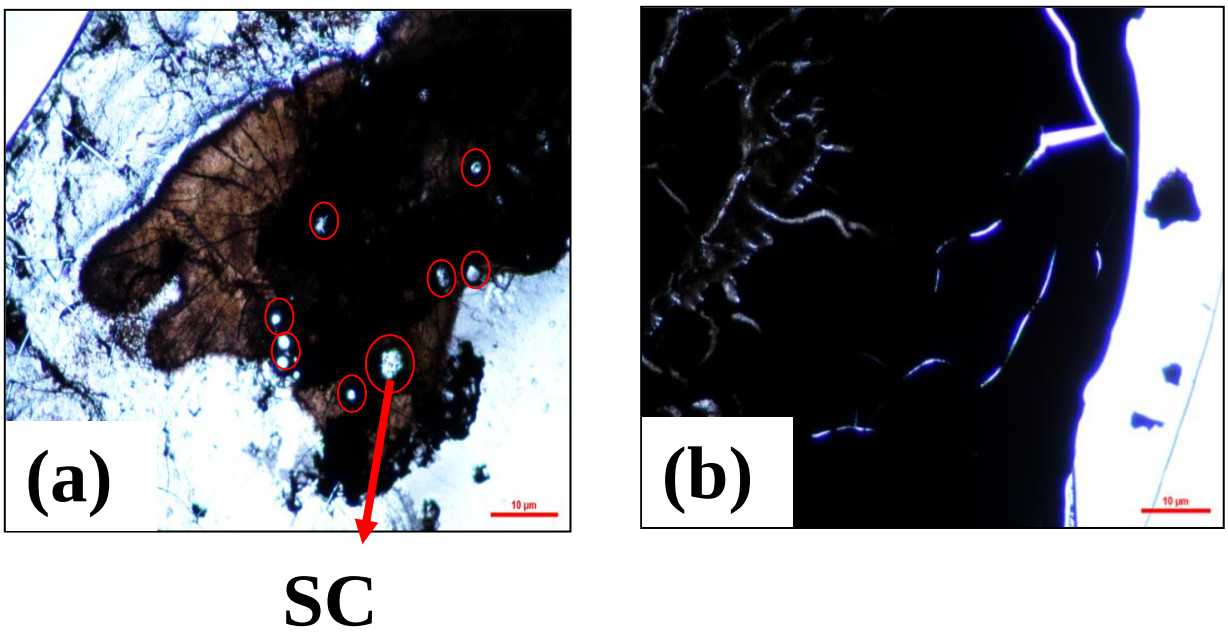
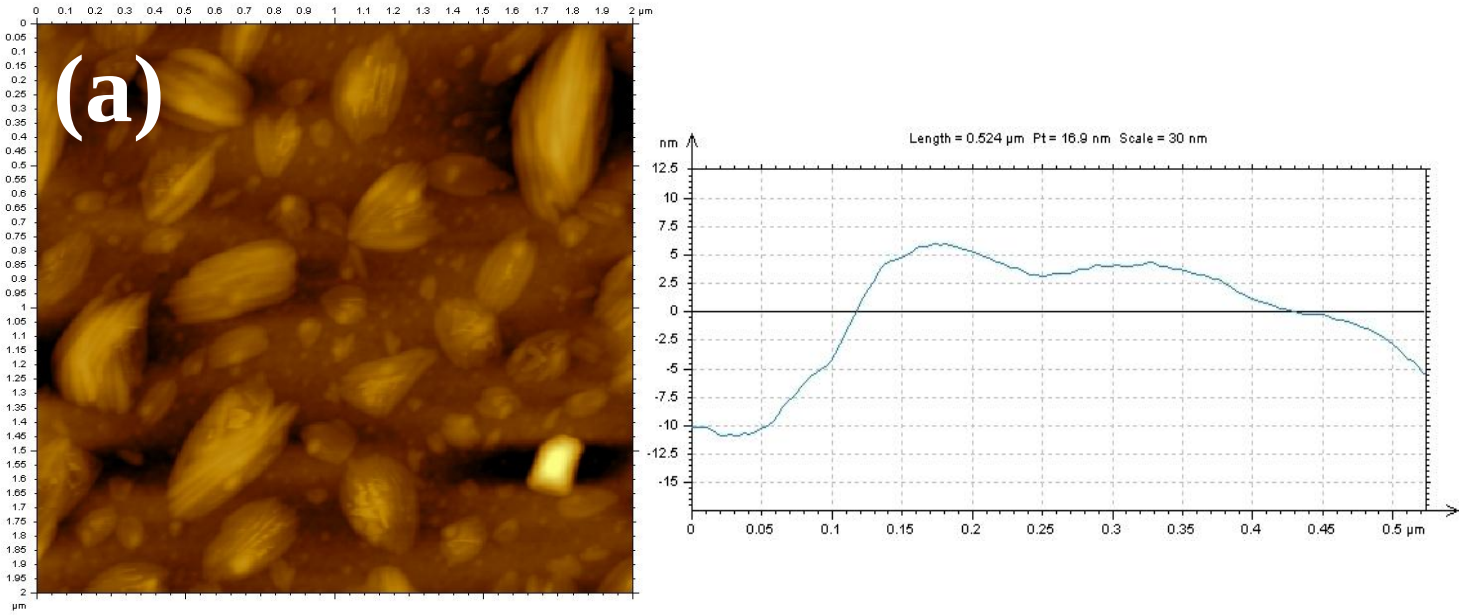


Figure (S4): Optical images of graphene dispersions (a) SC-G and (b) SDC-G drop-casted on glass substrates. Expulsion of SC surfactant from the graphene surface can clearly be observed.

AFM images



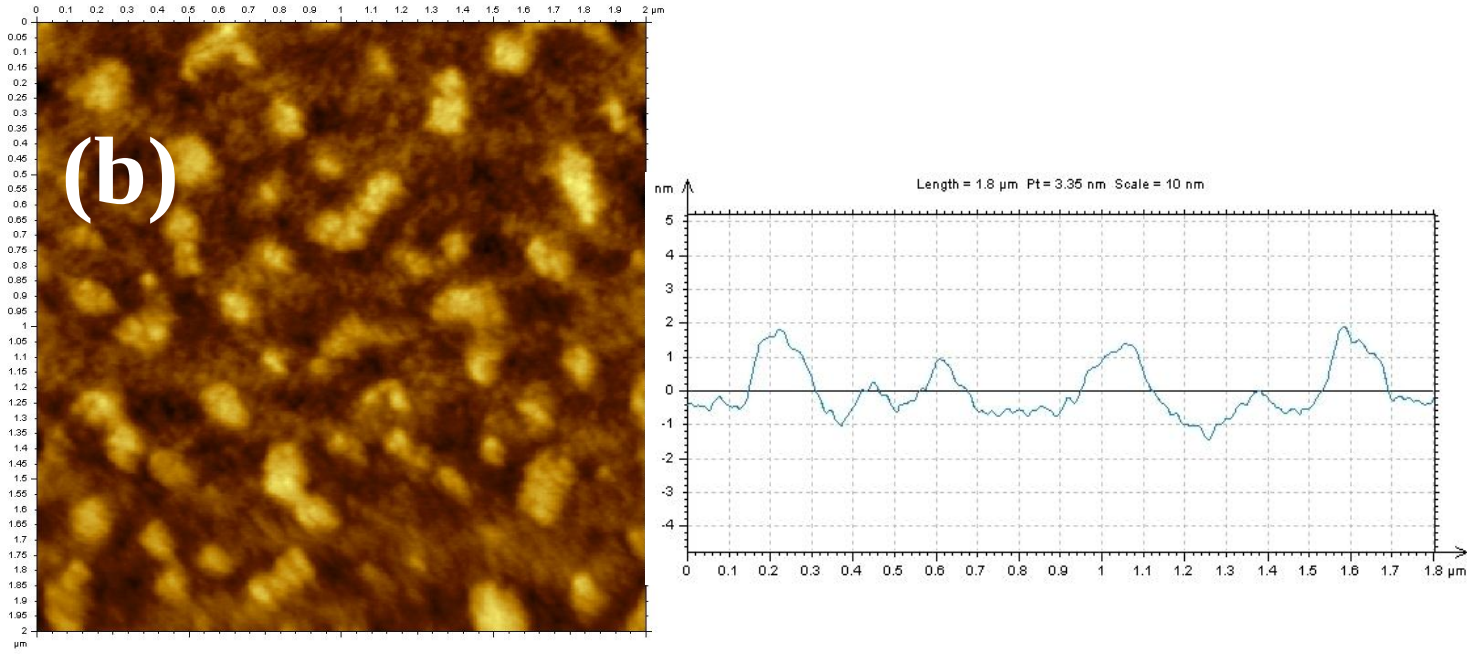


Figure (S5): AFM images of (a) SC-G and (b) SDC-G dispersions coated on glass substrate in the 2µm×2µm scale to visualize few layer graphene.

UV-Visible Transmittance Spectrum

UV-Visible Transmittance spectra of spin coated (1500rpm) SC-G and SDC-G dispersions on corning glass substrate and subsequently annealed under vacuum at 450˚C for one hour is shown in **Figure (S6)**. SDC-G coated substrate highly transmits (67%) the ultra-violet light as compared to SC-G coated substrate (59%). The inset shows the transmittance of both samples without annealing. The amount of transmittance is enhanced in both the cases with annealing as due to the elimination of surfactant and water molecules. As observed in Atomic force microscopy and Raman spectra of SDC-G coated graphene have few layers (1~5), but stacking of graphene layers is more in SC-G dispersion which forbids the transmittance of electromagnetic radiation in UV-visible region due to poor optical quality of the sample. Despite the fact that graphene multilayer is transparent to optical radiation, the observed transmittance of 67% for SDC-G coated glass

with expected thickness of 1-5 multilayers is very low. Hence, a detailed investigation as a function of graphene layers is mandatory for future transparent conducting anode applications.

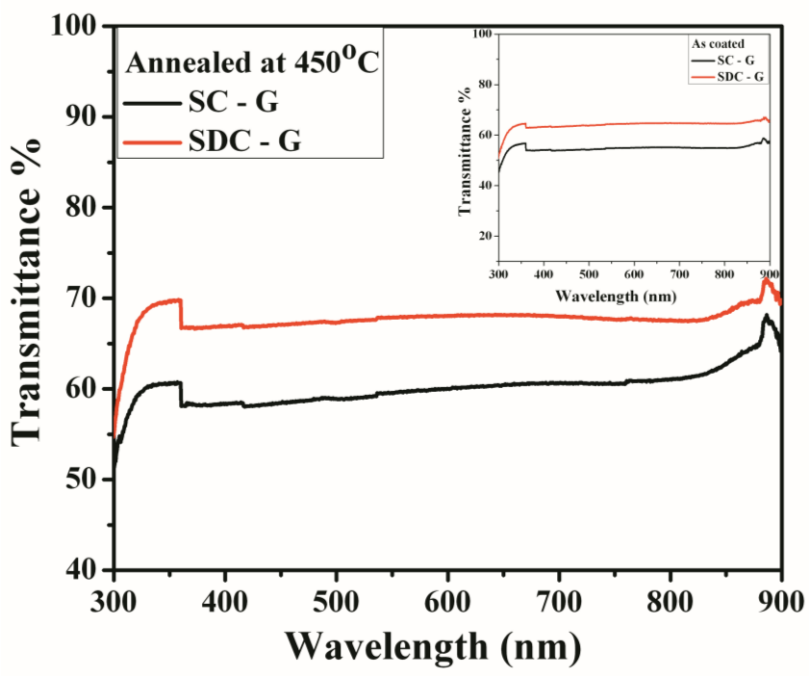


Figure (S6). UV-visible transmittance spectra of SC-G (0.2g/10mL) and SDC-G (0.05g/10mL) dispersions spin-coated on glass substrate and annealed at 450˚C in vacuum. The inset shows the transmittance of as-coated films.