Online Supporting Information for

Low-Temperature synthesis of $SrTiO_3$ nano-assemblies on DNA scaffold and their applications in Dye Sensitized Solar Cell and Supercapacitor

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Instruments.

The aggregated, $SrTiO_3$ nano-assemblies on DNA scaffold were characterized using several spectroscopic techniques. The transmission electron microscopy (TEM) and high resolution transmission electron microscopy (HR-TEM) analysis was done with a Tecnai model TEM instrument (TecnaiTM G2 F20, FEI) with an accelerating voltage of 200 KV. The UV-Visible (UV-Vis) absorption spectra were done in a Unico (model 4802) UV-Vis-NIR spectrophotometer equipped with a 1 cm quartz cuvette holder for liquid samples. The Energy Dispersive X-ray Spectroscopy (EDS) analysis was done with the Field Emission Scanning Electron Microscopy (FE-SEM) instrument (Zeiss ultra FE-SEM instruments) with a separate EDS detector (INCA) connected to that instrument. The X-ray diffraction (XRD) analysis was done using a PAN analytical Advanced Bragg-Brentano X-ray powder diffractometer (XRD) with Cu K_α radiation (λ = 0.154 nm) with a scanning rate of 7 degree per minute in the 2θ range 10-90°. The photoluminescence (PL) study was done with Varian

(Cary Eclipse Winflr) fluorescence spectrophotometer (serial number el02045776) both in excitation and emission mode using a xenon pump lamps. The Fourier Transform Infrared (FT-IR) spectroscopy analysis was done with the model Nexus 670 (FTIR), Centaurms 10X (Microscope) having spectral Range 4,000 to 400 cm-1 with a MCT-B detector. The thermal analysis study was recorded with a thermal analyser-simultaneous TGA/DTA instrument with model name SDT Q600 and the analysis was performed in air. A hot air oven (temperature up to 1000 °C) was used to anneal the samples at specific temperature. All the electrochemical experiments were examined using an AUTOLAB PGSTAT302N electrochemical work station in 2 M KOH aqueous solution. For DSSC sample preparation, the thickness of working electrode was measured by SJ-301 surface roughness tester. The conductivity (current-voltage, I-V) measurement was performed by using a solar simulator having model number SS80AAA under the light illumination of 1000 W/m2. A spin coater is used to prepare the counter electrode by using Hexachloroplatinic acid solution over glass substrate. The spin coater was purchased from Spektron Company, Chennai. The rotating speed was 1000 rpm and the samples were coated for 100 second over FTO plate for DSSC study.

Preparation of sample for different other characterizations.

The aggregated, $SrTiO_3$ nano-assemblies on DNA scaffold were characterized using UV-Vis, TEM, EDS, XRD, XPS, photoluminescence (PL), FT-IR, and thermal analyses. The $SrTiO_3$ nano-assemblies solution after successive centrifugation and annealing was used for the measurement in UV-Vis spectrophotometer after dispersing in aqueous solution. The solid $SrTiO_3$ powder was mixed with DI water, sonicated for 20 min, and used for TEM sample preparation and other thin films preparation. The dispersed $SrTiO_3$ nano-assemblies in aqueous solution were used for the PL measurement. The samples for TEM were prepared by placing a drop of the corresponding $SrTiO_3$ NPs solution onto a carbon coated Cu grid followed by slow evaporation of solvent at ambient conditions. The solid $SrTiO_3$ powder was directly used for XPS analysis. For EDS, XRD and FT-IR analysis, glass slides were used as substrates for thin film preparation. The slides were cleaned thoroughly in acetone and sonicated for about 20 min. The cleaned substrates were covered with the $SrTiO_3$ nano-assemblies solution and then dried in air. After the first layer was deposited, subsequent layers were deposited by repeatedly adding more $SrTiO_3$ nano-assemblies solution and drying.

Final samples were obtained after 5-6 times depositions and then analyzed using the above techniques. For TGA/DTA analysis, the as- prepared DNA-$SrTiO_3$ nanopowders are directly used for the measurement. The sample fabrication for supercapacitor and DSSC studies are given in main MS under experimental section.

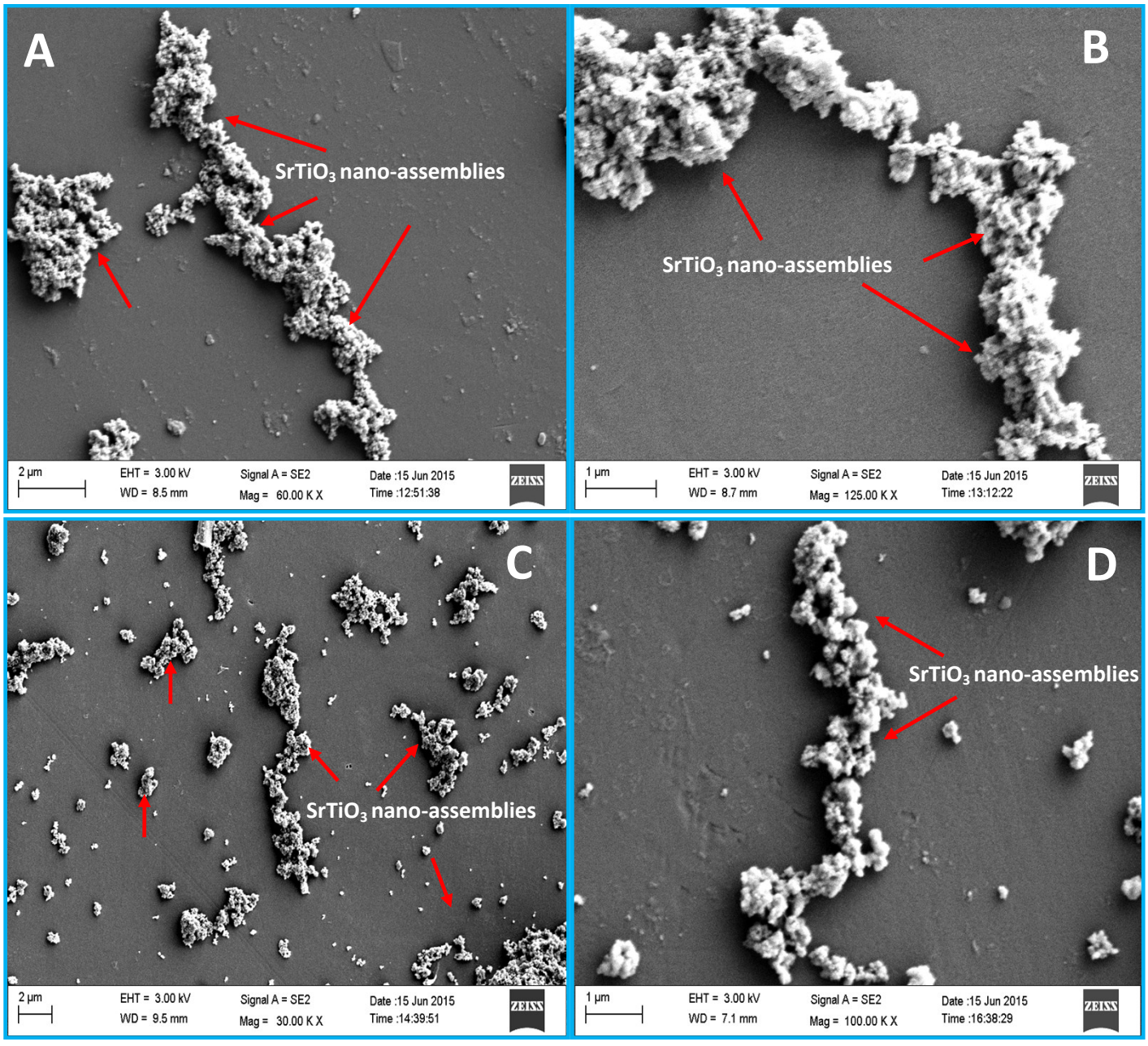

Figure S-1: Low and high magnified FE-SEM image of the smaller size $SrTiO_3$ nano-assemblies (A-B) and larger size $SrTiO_3$ nano-assemblies (C-D) on DNA scaffold.

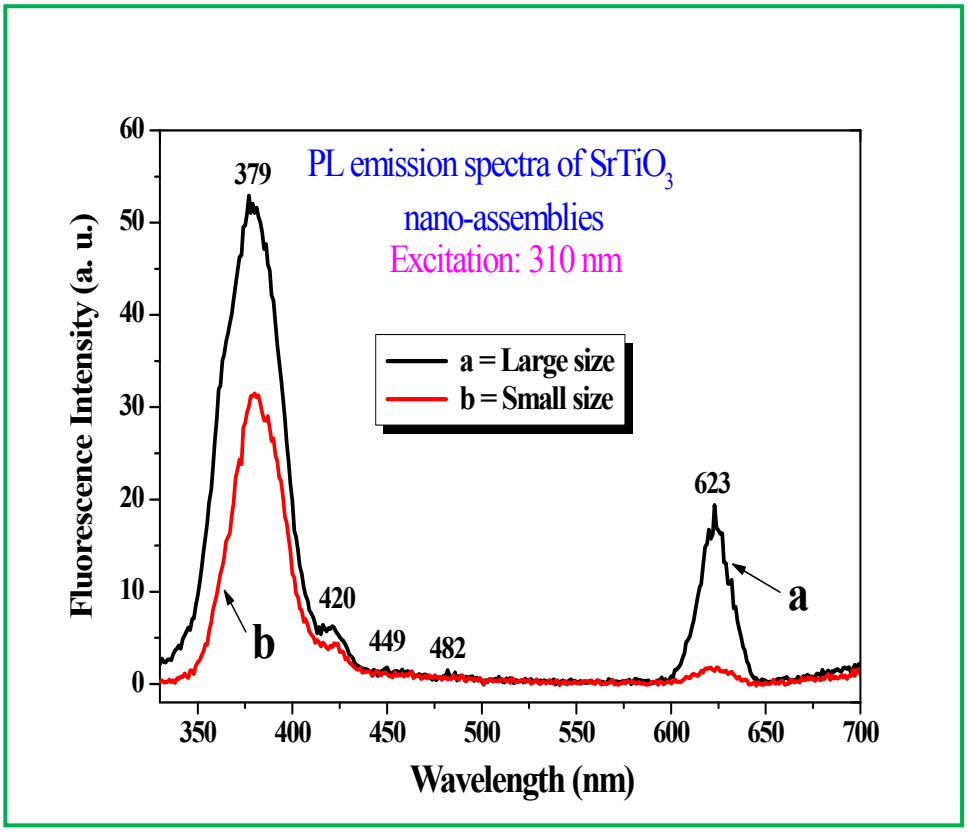

Figure S-2: The photoluminescence (PL) emission spectra of $SrTiO_3$ nano-assemblies on DNA with an excitation wavelength at 310 nm. Curve a and curve b indicate the $SrTiO_3$ nano-assemblies having large and small size respectively.

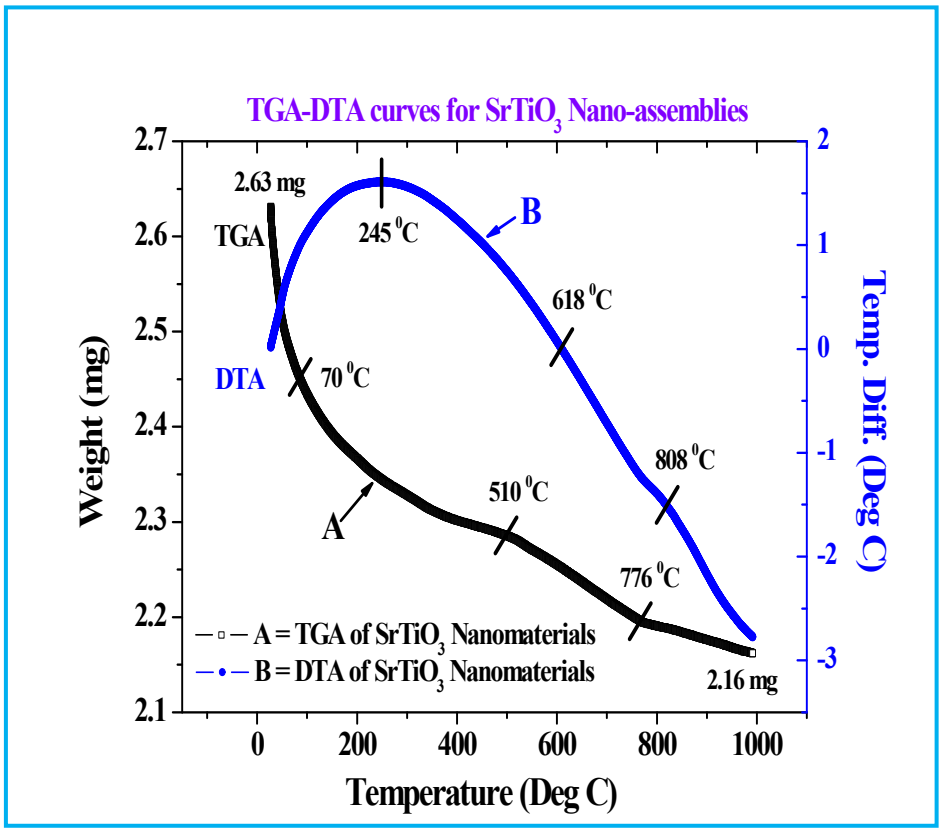

Figure S-3: The thermo gravimetric analysis (TGA) and differential thermal analysis (DTA) of the DNA- $SrTiO_3$ nano-assemblies where curve A indicates the TGA curve and curve B is the DTA curve respectively.

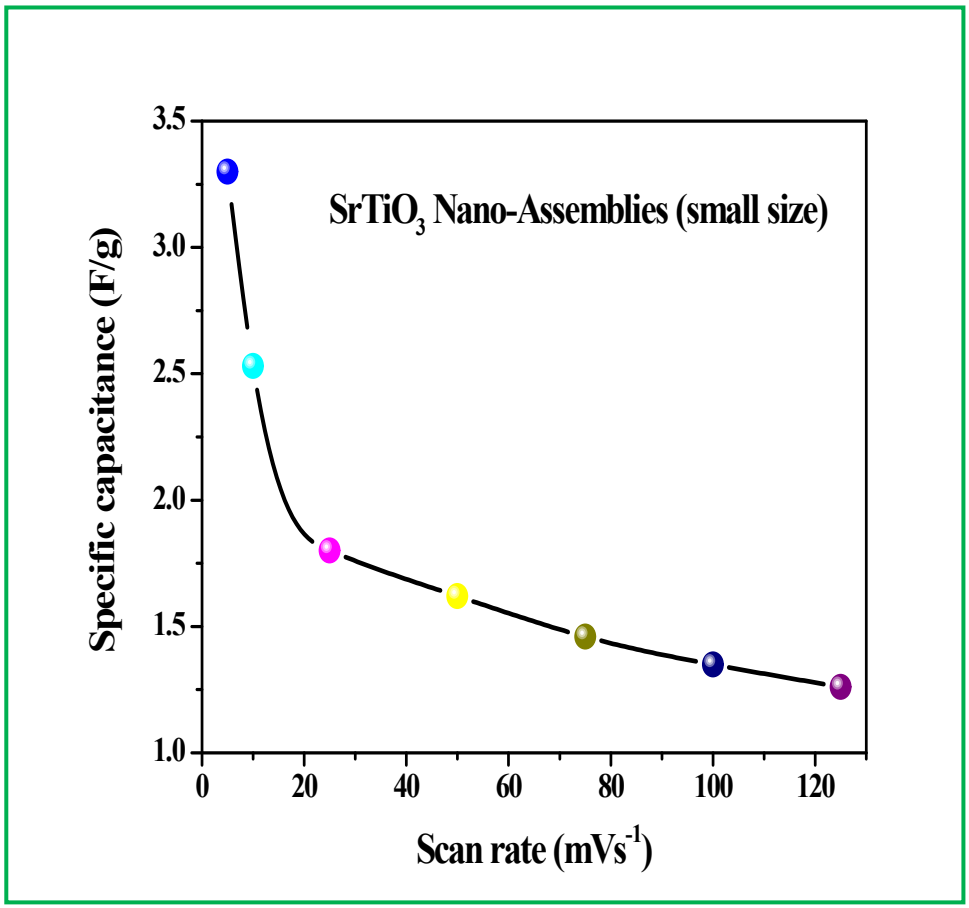

Figure S-4: Specific capacitance as function of scan rate for small size $SrTiO_3$ nano-assebmlies

Table S-1

Table S-2

Experimental and Reported FT-IR bands for DNA		
FT-IR bands (cm-1) (experimentally observed)	**FT-IR frequency range (cm^{-1}) (reported value)[70]**	**Absorbing bonds/vibration types**
3438	3100-3750	ν (OH group in DNA/water)
2884	2800-2950	Symmetric stretching vibration (C-H bonds in $–CH_2$ group)
1734	1750-1595	C=O, C-N, N-H[70]
1481	1496-1480	Bending (δ) of C-H bond in CH_2
1219	1170-1300	Asymmetric stretching of PO_2-group
1052	1150-990	ν (C-O-C, C-C)[70]

Table S-3

S.No	Name of the material	Synthesis methodology	Jsc (mA/cm^2)	V_{oc} (V)	FF (%)	η (%)	ref no.
1	$SrTiO_3$ graphene composite	Hydrothermal method @200 ^oC for 50 h	17.09	0.95	0.58	8.79	49
2	$SrTiO_3$ NPs	Hydrothermal method@ 120 or 200 ^oC for 24 h.	0.76	1.53	0.67	0.78	50
3	$SrTiO_3/TiO_2$-P25	Ball milling @ 1200 ^oC for 2 h	12.8	0.73	0.56	5.32	78
4	$SrTiO_3$ nano-assemblies (small size)	Solvo thermal @ 80 ^oC for 2 h	2.25	0.44	46	0.0046	This work

Set	Final Conc.	Final conc.	Amount	Volume of	Total	Shape of the	Approx. size

Reference 49,50,78 as shown here are given under main text.