

## Electronic Supplementary Information (ESI) for

### Aero-gel assisted synthesis of anatase TiO<sub>2</sub> nanoparticles for humidity sensing application

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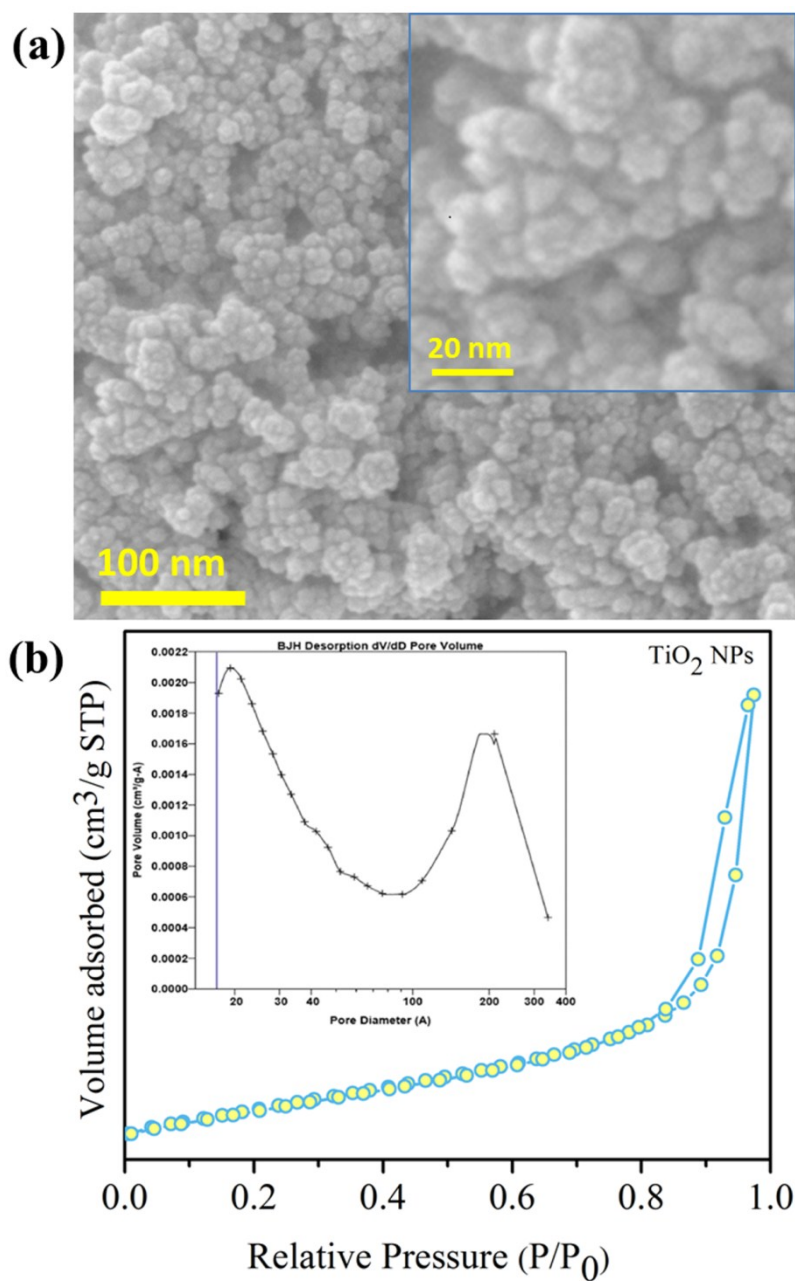
# Both authors have contributed equally to this work.

## **Procedure for fabrication and performance test of humidity sensor**

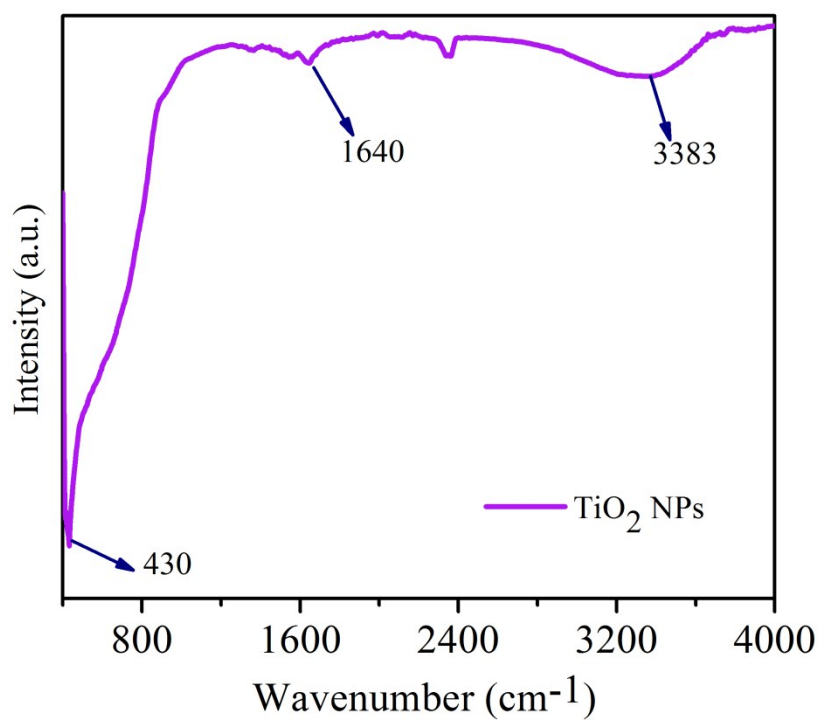
In order to measure the humidity sensing behavior of as-synthesized TiO<sub>2</sub> nanoparticles, a dilute paste of sample was prepared with ethanol in a weight ratio of 1:20 which was drop casted on a ultrasonically treated clean Ag–Pd inter digital electrode (13.4mm x 7mm x 0.5mm) followed by drying in oven at 70 °C for 2h to allow evaporation of solvent. The sensing module was formed by utilizing obtained dried coated substrate to scrutinize various humidity sensing attributes. To achieve controlled and fixed humidity environments, air tight containers were loaded with 6 different saturated aqueous salt solutions LiCl, MgCl<sub>2</sub>.6H<sub>2</sub>O, Mg(NO<sub>3</sub>)<sub>2</sub>.6H<sub>2</sub>O, NaCl, KCl and K<sub>2</sub>SO<sub>4</sub> which yielded 11%, 33%, 54%, 75%, 84% and 98% relative humidity, respectively at ambient conditions. The ceramic electrode coated with TiO<sub>2</sub> NPs was exposed to these containers for the uptake of water molecules and corresponding RH response curves were obtained by measuring change in resistance, utilizing a two-probe arrangement (in 4 Wire mode) with a source measure unit (Keithley) by applying a constant source voltage.

## **Characterization**

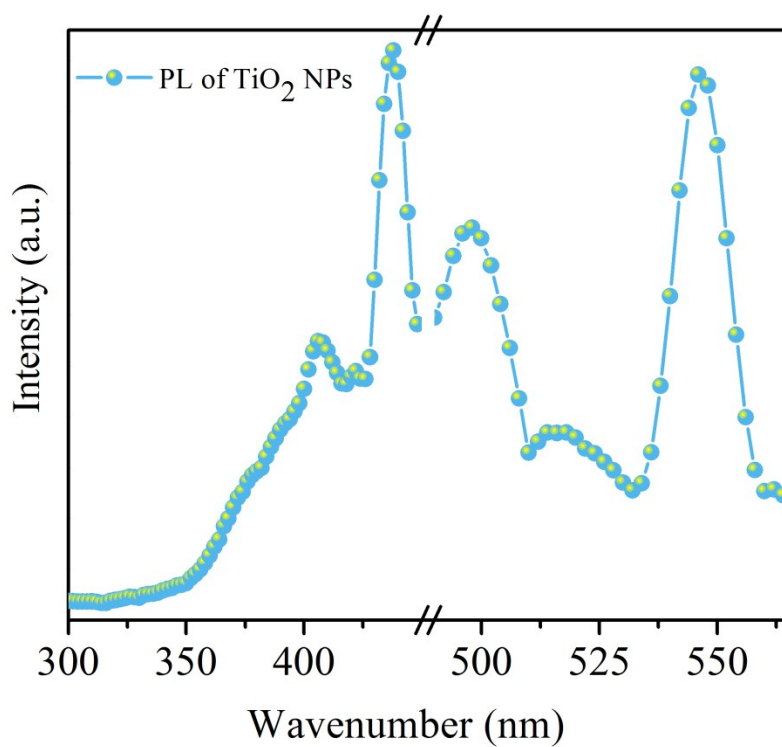
The surface area and pore size distribution of TiO<sub>2</sub> NPs was measured on ASAP Micromertics 2010, USA. Initially the sample was degassed at 225°C for 6 h under vacuum (10<sup>-2</sup> Torr) and after that cooled at room temperature. The N<sub>2</sub> adsorption and desorption isotherm was recorded at liquid nitrogen temperature. Brunauer-Emmet-Teller (BET) method was used to determine the surface area and micro pore volume of TiO<sub>2</sub> nanoparticles. XRD pattern was recorded on XPERT-PRO MRD 3055, The Netherlands using CuKα radiation ( $\lambda = 0.15418$  nm) source with applied voltage of 40 kV. The diffractogram was recorded at 2 theta values of 10 to 85° changing with a speed of 0.05° sec<sup>-1</sup>. HRTEM and SAED images were captured using JEOL, JEM-1200 Ex, Japan. 10 mg of TiO<sub>2</sub> was mixed with 5 mL of ethanol and sonicated for 2 h. A drop of supernatant solution was placed on the copper grid of 200 mesh size. Imaging at different scales was performed to estimate the proportion of smaller particles. The X-Ray photoelectron spectroscopy (XPS) was recorded by applying both Mg Kα (1253.6 eV) and Al Kα (1486.7 eV) radiation sources. The calibration of the work function of the system and the binding energy in the photoemission spectra was carried out referring to the Au 4f 7/2 emission line and the Au Fermi level. The core level (CL) curve fitting was done using a Shirley background and Voigt (mixed Lorentzian–Gaussian). Fourier-transform infrared (FTIR) spectra were recorded in the range of 400–4000 cm<sup>-1</sup> using FTIR spectroscopy (Perkin Elmer- Frontier FTIR). The room temperature Photo-luminescence (PL) spectra were obtained on Perkin Elmer LS-55 Fluorescence spectrometer.



**Figure S1:** (a) SEM image of the TiO<sub>2</sub> NPs and (b) N<sub>2</sub> Adsorption-desorption isotherms of TiO<sub>2</sub> NPs and (inset) BJH pore size distribution curve



**Figure S2:** FTIR spectrum of TiO<sub>2</sub> NPs



**Figure S3:** Photoluminescence spectrum of TiO<sub>2</sub> NPs