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Electronic Supplementary Information (ESI†)

Viscoelastic Nanocomposite Composed of Titania Nanosheets: Multiple Conductometric Sensitivities

Yukihiro Yoshida,*[a] Kazuya Kai,[b] Hiroshi Kageyama[bc] and Gunzi Saito[a]

[a] *Research Institute, Meijo University, Shiogamaguchi 1-501 Tempaku-ku, Nagoya 468-8502, Japan. Fax: +81-52-833-7200; Tel: +81-52-838-2552; E-mail: yyoshida@meijo-u.ac.jp*

[b] *Department of Energy & Hydrocarbon Chemistry, Graduate School of Engineering, Kyoto University, Nishikyo-ku, Kyoto 615-8510, Japan*

[c] Institute for Integrated Cell-Materials Science, Kyoto University, Sakyo-ku, Kyoto 606-8501, Japan

Measurements. FT-IR spectra were measured on KBr pellets or in dispersed KBr pellets with a Perkin-Elmer 1000 Series spectrophotometer. UV-Vis-NIR spectra were measured on quartz substrates using a Shimadzu UV-3100 spectrophotometer. Fluorescence emission spectra were recorded on quartz substrates using a Horiba FluoroMax-4P spectrofluorometer. Excitation wavelength is 250 nm. EDS experiments were conducted with a JEOL JSM-5510LVN Scanning Electron Microscope operated at 20 kV. The nanocomposite was mounted onto carbon tape. Powder XRD measurements were carried out with a MAC Science M18XHF diffractometer using Cu Kα radiation at a scanning rate of 0.01° s^{-1} in a 2θ range of 5–80°. Rheology measurements were conducted on a Thermo Scientific HAAKE MARS rheometer at 25 °C. The moduli *G*' and *G*" were measured on frequency sweep from 10^{2} and 10^{-3} Hz under a constant strain of 0.1%, and on strain sweep from 10^{-2} to 5% at a constant frequency of 1 Hz. Ionic conductivities were measured using a Wayne Kerr impedance analyzer 6440B over the frequency range between 20 Hz and 3 MHz. The nanocomposite was filled in a conductivity cell constructed with a pair of ITO glasses (surface resistance: 10 Ω/□) as electrodes and acetate films as a spacer (cell constant: 6.0×10^{-2} cm^{-1}), and the cell was placed in a temperature (25–80 °C) and humidity (50–95% RH) controlled chamber

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ESPEC SH-221. A 200 W Xe lamp (San-ei Electric, XEF-501S) was used as the white light source, and a UV intensity of *ca.* 50 mW cm^{-2} was determined with a solarmeter (San-ei Electric, ANS-001).

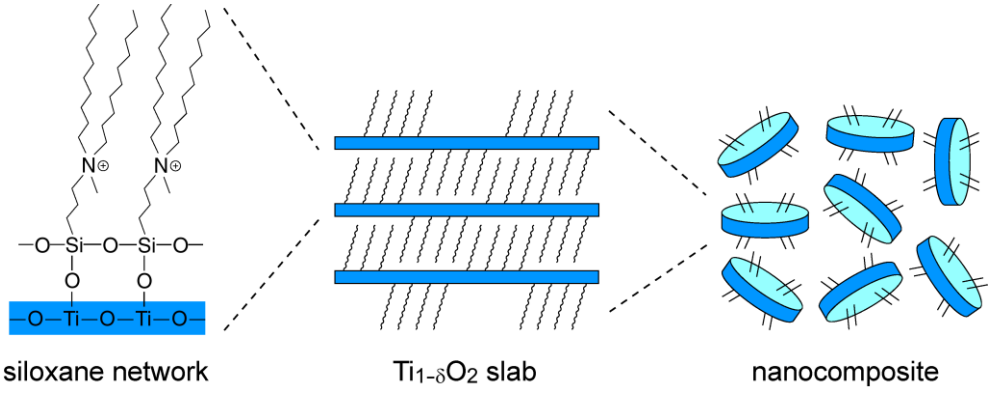

Figure S1. Schematic models of a siloxane graft network imprinted on a $Ti_{1-\delta}O_2$ nanosheet (left), a $Ti_{1-\delta}O_2$ slab (middle), and the nanocomposite structure (right).

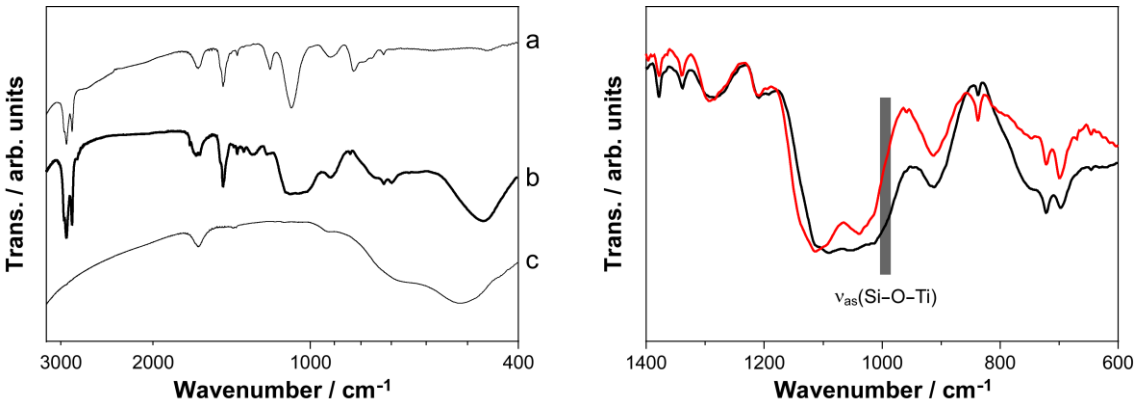

Figure S2. (Left) Infrared spectra of (a) $[(CH_3O)_3Si(CH_2)_3N(CH_3)(C_{10}H_{21})_2]Cl$, (b) WNC, and (c) layered protonated $Ti_{1-\delta}O_2$, dispersed in compressed KBr pellets. (right) Enlarged spectra of WNC (black line) and nanocomposite prepared by adding $[(CH_3O)_3Si(CH_2)_3N(CH_3)(C_{10}H_{21})_2]Cl$ methanol solution to tetramethylammonium hydroxide aqueous solution (red line) in the frequency range of 600–1400 cm^{-1}.

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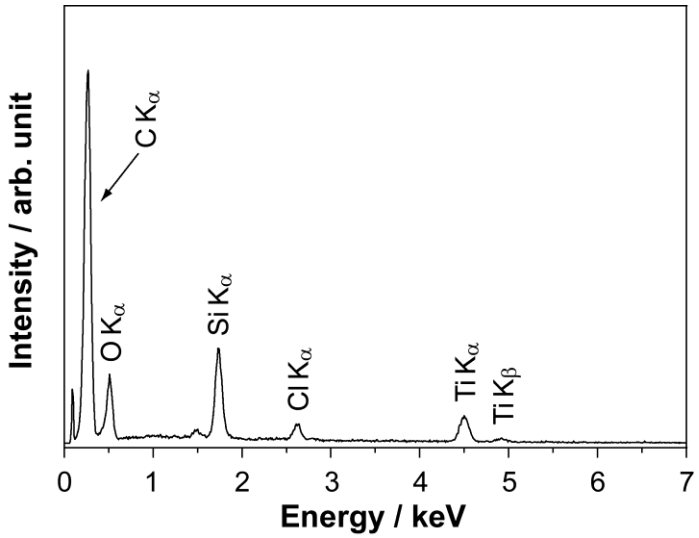

Figure S3. EDS spectrum of DNC.

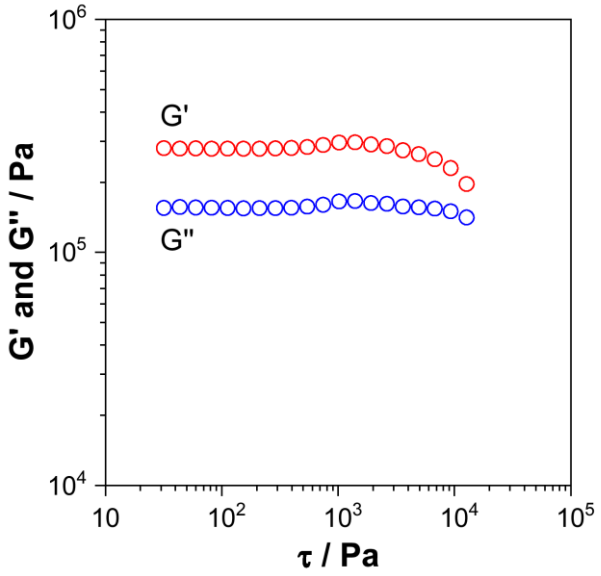

Figure S4. Stress dependences of dynamic storage (*G*', red circles) and shear-loss (*G*", blue circles) moduli of WNC at a constant frequency of 1 Hz at 25 °C.

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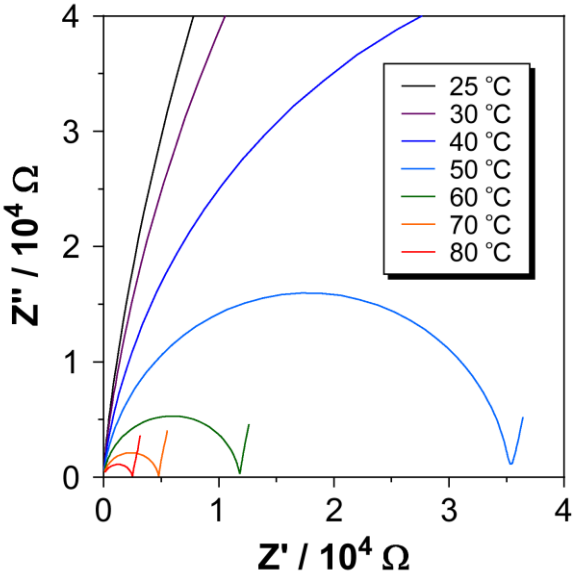

Figure S5. Impedance Cole-Cole plots of the nanocomposite under 50% RH, as a function of temperature.

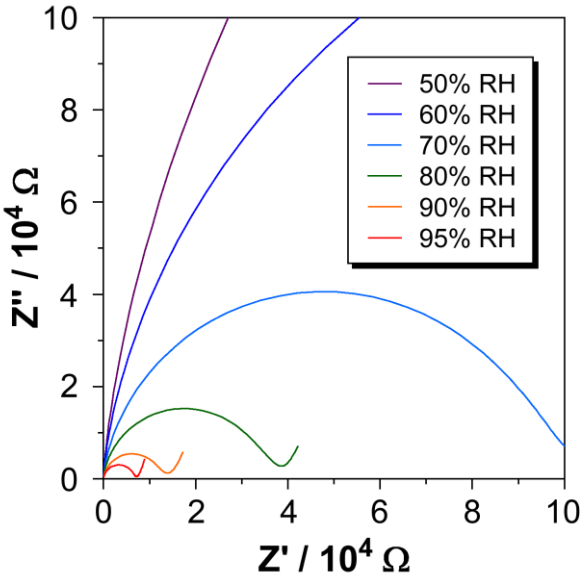

Figure S6. Impedance Cole-Cole plots of the nanocomposite at 25 °C, as a function of relative humidity.