

Supporting Information  
For

## Super-thermostable Platinum Nanoparticles on Fluorinated Clay

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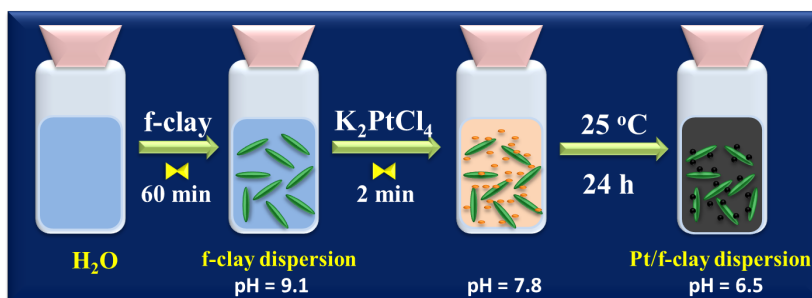
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### EXPERIMENTAL SECTION

**Materials.** Fluorinated inorganic clay used in this study ( $[\text{Mg}_{5.34}\text{Li}_{0.66}\text{Si}_8\text{O}_{20}(\text{F})_4]\text{Na}_{0.66}$ ) was purchased from Rockwood, Ltd., UK, and used after being washed and vacuum-dried. Analytical-grade potassium tetrachloroplatinate (II) ( $\text{K}_2\text{PtCl}_4$ ), 4-nitrophenol ( $\text{C}_6\text{H}_5\text{NO}_3$ ), and  $\text{NaBH}_4$  were purchased from Wako Pure Chemical Industries, Japan. All chemicals were used as supplied. Ultrapure water, supplied by a PURIC-MX system (Organo Co., Japan), was used for all experiments.

**Preparation of Pt/f-clay NC.** A typical experimental procedure for preparing the nanostructured Pt/f-clay NC is described in **Scheme S1**. The dispersion was prepared by swelling the fluorinated clay (0.1 g) in deionized water (10 g) at 40 °C for 60 min. In the resulting dispersion (1 wt%), aged  $\text{K}_2\text{PtCl}_4$  solution (50  $\mu\text{L}$ ; 5 wt%) was added with continuous stirring for 2 min. Mixtures containing fluorinated clay and Pt species were stored in the dark under static conditions at room temperature ( $25 \pm 1$  °C). The formation of Pt nanoparticles was indicated by a color change in the reaction solution from light brown-yellow to opaque black within 24 h of mixing.

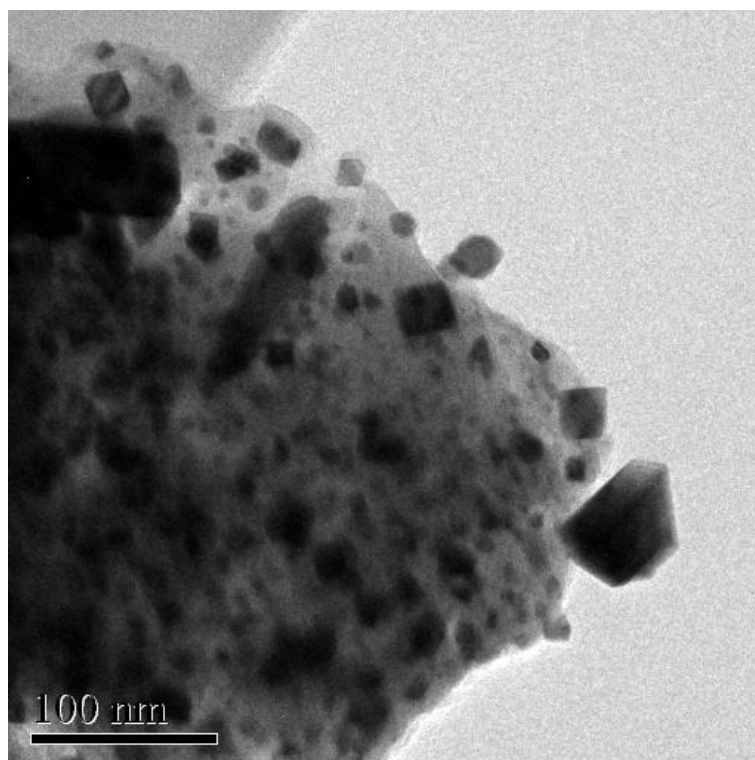


**Scheme S1:** Preparation of Pt/f-clay NC

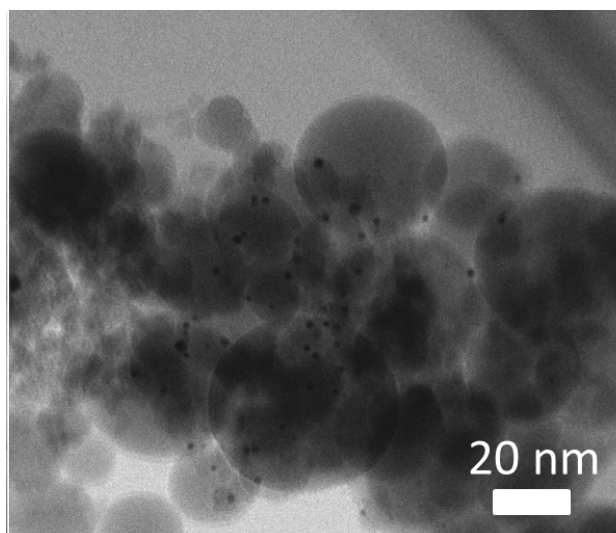
**Catalytic Reduction of 4-Nitrophenol:** A 0.5 mL sample of aqueous sodium borohydride (60 mmol/L) was added to 2.5 mL sample of aqueous 4-nitrophenol (0.12 mmol/L) in a quartz cuvette. Subsequently, 0.01 g of as-prepared Pt/f-clay material was added. Immediately after adding the composite particles, UV spectra of the sample, from 300–500 nm, were recorded at

1 min intervals at 25 °C. For comparison, analogous measurements were performed with f-clay alone, instead of the Pt/f-clay NC.

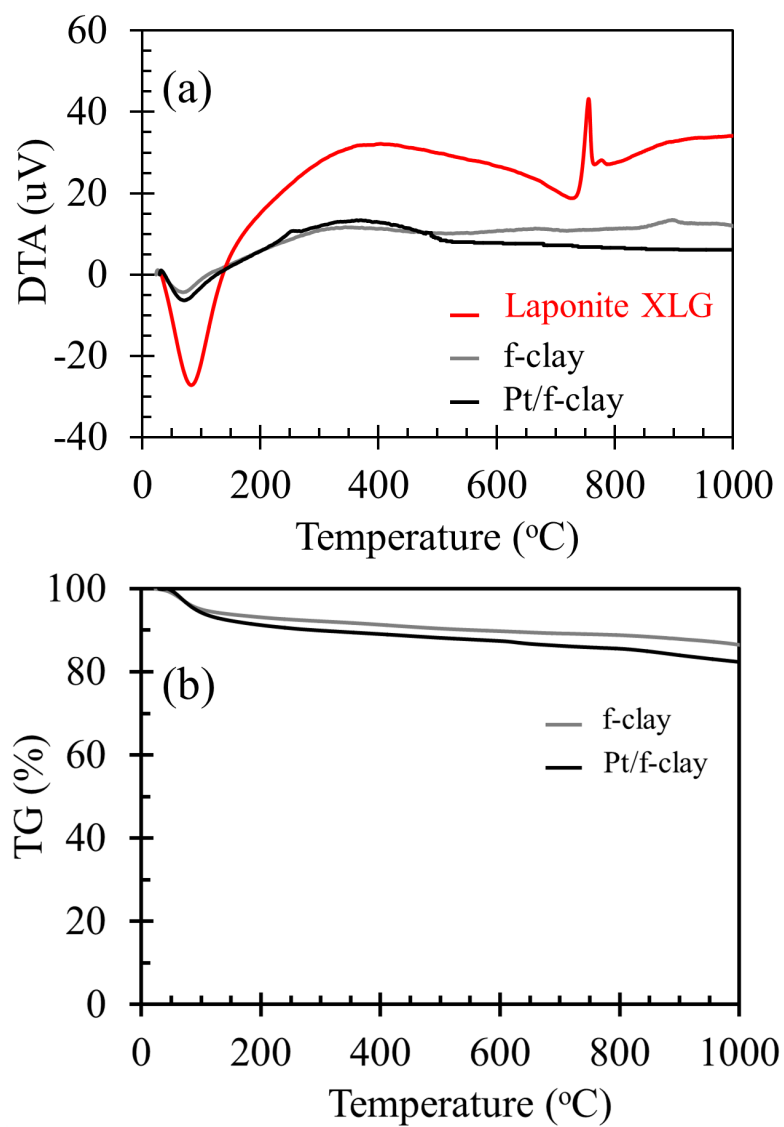
**Characterization.** UV-vis absorption spectra of the Pt nanoparticles in the fluorinated clay dispersion were acquired in a 1 mm quartz cuvette at room temperature using a Hitachi U-4100 UV-visible double-beam spectrometer. For the reference blank, a solution with the same composition as the sample but without the added metal precursor was used. The morphology of the nanoparticles was examined using a high-resolution field-emission transmission electron microscope (JEM-2200TFE, JEOL) operating at 200 kV. Samples were prepared by depositing single drops of the dilute sample solutions onto carbon-coated Cu grids and drying them at room temperature. Energy dispersive X-ray spectroscopy (EDS) was performed using a scanning transmission electron microscopy (STEM) detector fitted on a JEOL JEM-2200TFE instrument operating at 200 kV. XRD patterns were obtained using a Rigaku SmartLab X-ray diffractometer with monochromated Cu K $\alpha$  radiation (40 kV, 100 mA). Nitrogen adsorption–desorption data was obtained using a BELSORP-mini II (BEL JAPAN Inc.) operated at 77 K. Prior to measurement, the sample was added to the measurement cell, which was placed in a drying machine and maintained at 80 °C overnight. After drying, helium gas was added to the cell.



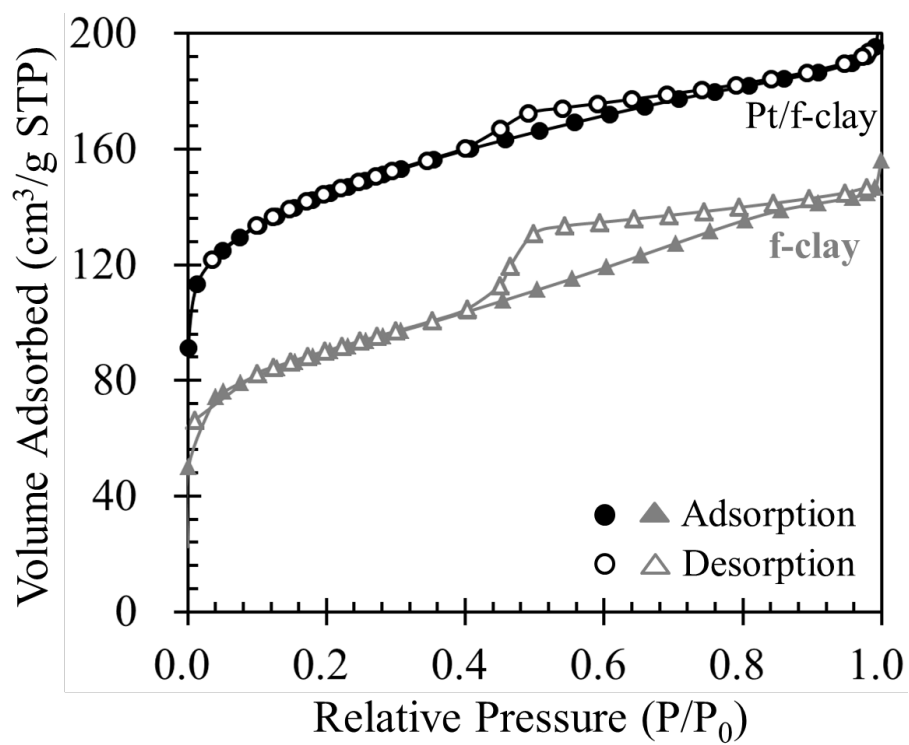
**Figure S1:** TEM image of the Pt/non-fluorinated clay NC upon calcination for 1 h in air at 500 °C. The non-fluorinated clay used was laponite XLG.



**Figure S2:** TEM image of the Pt/SiO<sub>2</sub> NC upon calcination for 1 h in air at 300 °C.



**Figure S3:** (a) DTA curves for f-clay and non-fluorinated clay (laponite XLG) and Pt/f-clay NC. (b) Thermogravimetric analysis (TGA) for f-clay and Pt/f-clay NC.



**Figure S4:** N<sub>2</sub> adsorption-desorption isotherm for f-clay and Pt/f-clay NC.