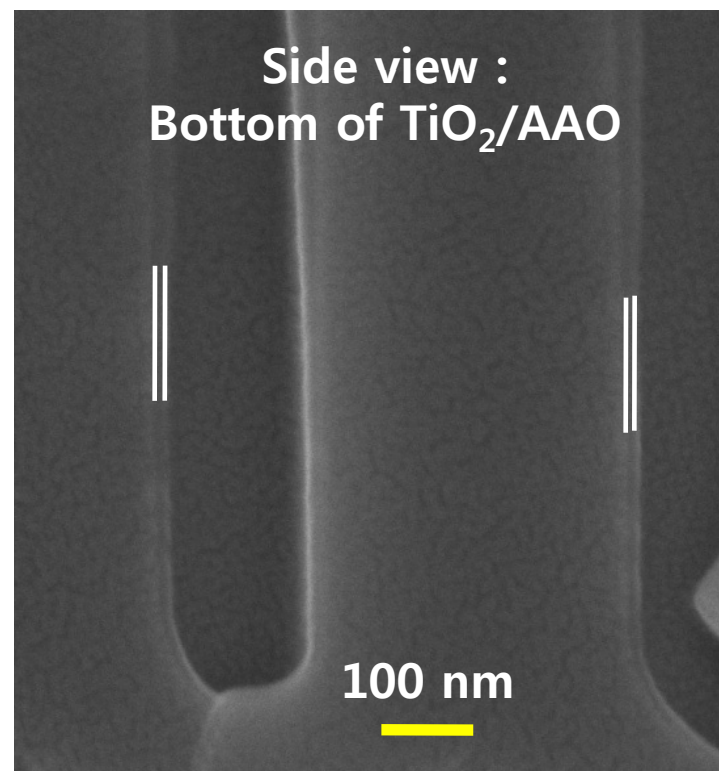
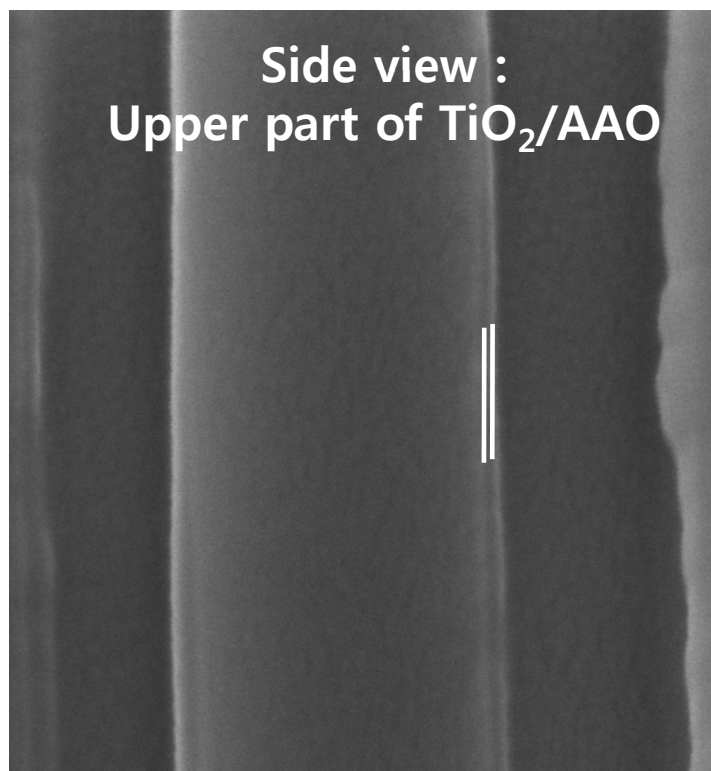


The specially designed experimental set-up for real-time monitoring of toluene adsorption onto TiO_2 nanostructures is depicted. Briefly, a reactor and an analysis chamber equipped with a quadrupole mass spectrometer are separated by a leak valve (valve 1). A gate valve (valve 2) was used for dividing the reactor into two parts. After the reactor was thoroughly pumped out using a rotary pump, the gate valve was closed, and a mixture of N_2 and toluene was inserted into the reactor. A small portion of the gas mixture was injected into the analysis chamber, and a mass spectrum was obtained using the quadrupole mass spectrometer (Hiden analytical). After the gate valve was opened, the gas composition in the reactor was regularly determined by leaking the probe gas from the reactor into the analysis chamber via the leak valve. The measurement of changes in the partial pressure of toluene with respect to that of nitrogen were directly correlated to the number of toluene molecules adsorbed on the surface of the samples. Samples were fixed using metal clips onto the sample stage. Powder samples were pelletized for these measurements.

SEM images



Number of toluene molecules adsorbed

Initial toluene pressure 5 mtorr

Reactor volume : 0.46 L

Using $PV=nRT$, number of toluene molecules at the beginning of each experiment can be determined: 8.1×10^{16} molecules.

From the experimental data in Fig. 2c, the relative amount of toluene removed can be determined. Consequently, the number of toluene molecules adsorbed can be determined.

5.4×10^{16} molecules for 200 cycled TiO_2/AAO , and

6.5×10^{16} molecules for 300 cycled TiO_2/AAO .

Surface area of a pore of AAO

$2 \times 3.14 \times \text{pore radius} \times \text{AAO thickness}$

Pore radius :

100 nm for bare AAO, 88 nm for 200 cycled sample, 82 nm for 300 cycled sample.

AAO thickness : 30 μm

Pore density = $5 \times 10^8/\text{cm}^2$

Total surface area of each sample = Area of sample \times pore density \times area of each pore.

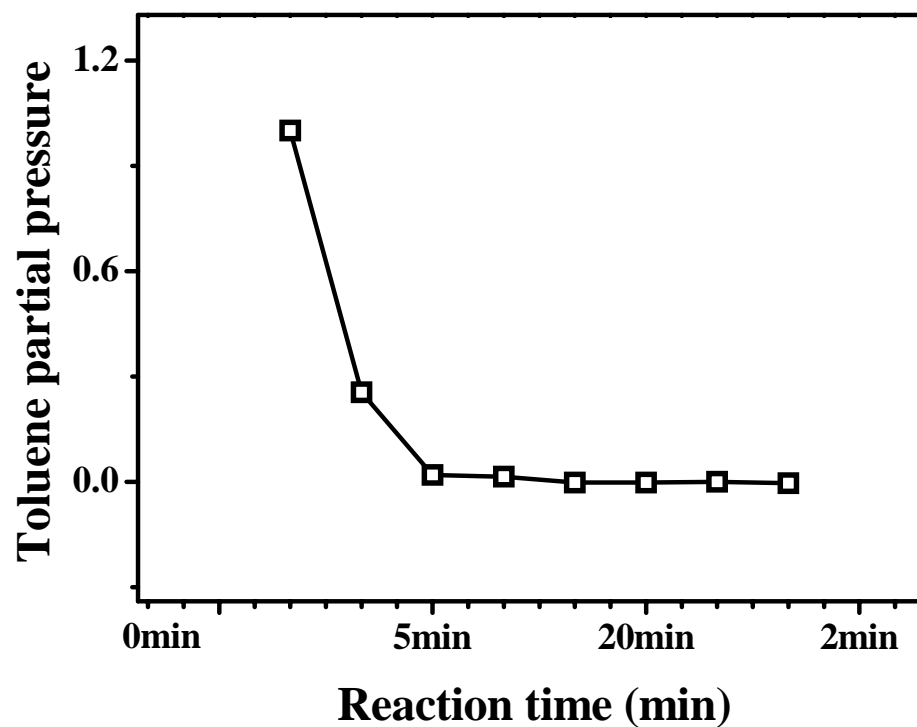
= 190 cm^2 for bare and 200 cycled TiO_2/AAO

= 170 cm^2 for 300 cycled TiO_2/AAO .

Surface density of Toluene molecules:

200 cycled TiO_2/AAO : 2.8×10^{14} molecules/ cm^2

300 cycled TiO_2/AAO : 3.8×10^{14} molecules/ cm^2



TiO₂/AAO (300 cycles) was used for toluene adsorption experiment. Initially toluene partial pressure in the chamber was 5 mtorr, and whereas that of N₂ 80 mtorr. O₂ partial pressure was 20 mtorr. Toluene can be completely removed within 5 minutes