# Supplementary Materials

## Nanoscale effects of TiO2 nanoparticles on the rheological behaviors of ultra-high molecular weight polyethylene (UHMWPE)

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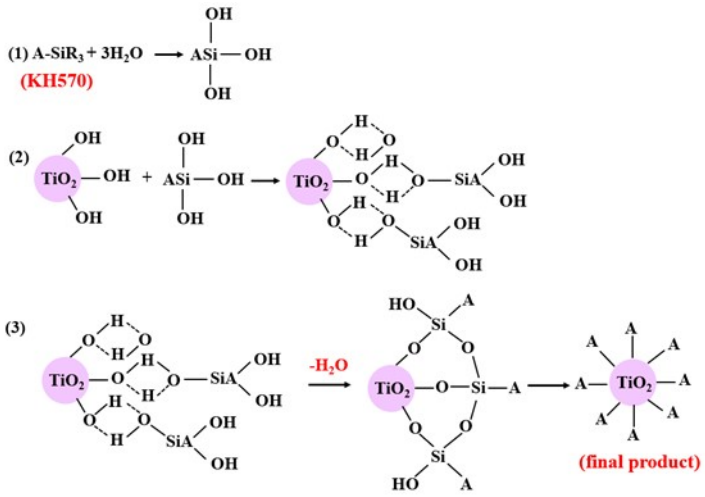
The mechanism of the surface modification of nano-$TiO_2$ by KH570 is shown as **scheme 1** [1], which is very similar to our previous study[2]. The chemical formula is $CH_2=C(CH_3)COO(CH_2)Si(OCH_3)_3$ and its reaction with nano-$TiO_2$ consists of three steps: (1) the -R group attaches to the silicon atom hydrolyzes to form Si-OH oligosiloxane; (2) the Si-OH in oligosiloxane forms a hydrogen bond with the -OH on the surface of nano-$TiO_2$; (3) covalent bond with $TiO_2$ is formed along with dehydration reaction during the heating process.




**Scheme S1.** Mechanism of the surface modification of $TiO_2$ nanoparticles by KH570 (A stands for $CH_2=C(CH_3)COO(CH_2)$ and R is $OCH_3$)

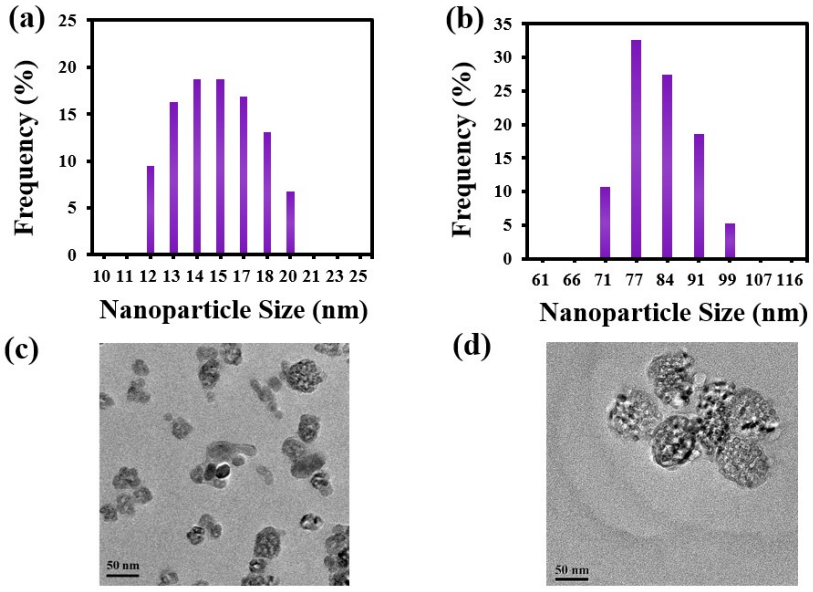



**Fig. S1.** Size distribution of modified (a) 6-10 nm and (b) 70 nm $TiO_2$ nanoparticles. TEM morphologies images of modified (c) 6-10 nm and (d) 70 nm nanoparticles.

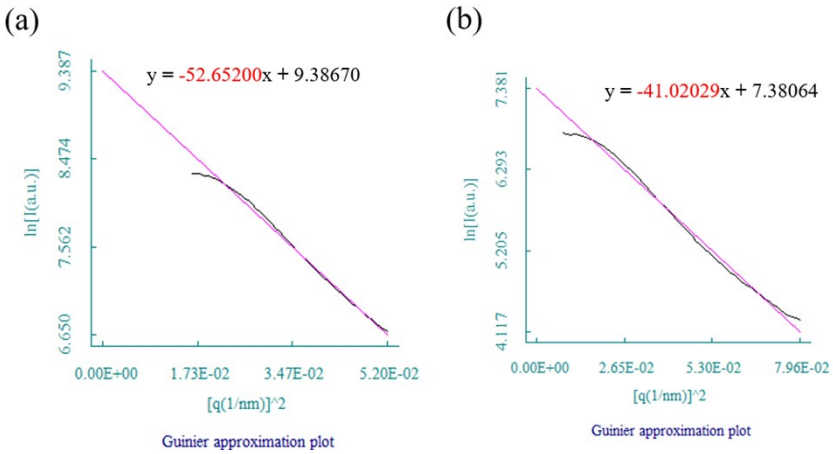



**Fig. S2.** Guinier approximation plot of pure UHMWPE (a) and the UHMWPE/0.3% $TiO_2$ composite (b).

The natural logarithm of the equation $I(q) = I(0)exp(-R_g^2q^2/3)$ [29] is $ln\,I(q) = lnI(0) - R_g^2q^2/3$. Then the gyration radius of the sample ($R_g$) can be calculated through the slope of Guinier approximation plot, that is Slope $= -R_g^2/3$. For pure UHMWPE, $R_g = \sqrt{(-3) \times (-52.65200)}$ = 12.57 nm; For UHMWPE/0.3% $TiO_2$, $R_g = \sqrt{(-3) \times (-41.02029)}$

= 11.09 nm.

References:

1. J. Liu, J. Yu, M. He and S. Lu, Chinese Journal of Colloid & polymer, 2010, 28, 19-21.

2. Y. Cui, Y. Sui, P. Wei, Y. Lv, C. Cong, X. Meng, H. Ye and Q. Zhou, Nanomaterials, 2023, 13, 1096.