Supplementary Material

Advanced removal of toluene in aerosol by adsorption and photocatalytic degradation of silver doped TiO_2/PU under visible light irradiation

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1. FTIR results

Figure S1 shows the presence of the urethane group (-NH-CO-O-), containing N-H, C-N, C=O, and C-O bonds, in the FTIR spectrum of the pristine PU [1, 2]. Compared to the spectrum of the pristine PU, the FTIR spectrum of the pre-treated PU showed a decrease in the intensities of the peaks corresponding to the urethane groups (N-H, C-N, C=O and C-O), with new occurrence of peaks corresponding to the isocyanate group (-N=C=O) [3]. This indicates that isocyanate group was successfully introduced into the pristine PU. The FTIR spectrum of the TiO_2/PU showed that the isocyanate group in the pre-treated PU continuously reacted with the amine group in the amino titanosiloxane to form a urethane group, which caused immobilization of titanosiloxane on the surface of the PU. The immobilization was confirmed by comparison between the FTIR spectra of the pre-treated PU, TiO_2/PU and 6 % Ag-TiO_2/PU, the latter two of which showed strong increases in the N-H and C=O peaks, corresponding to the peaks of the urea group (-NH-CO-NH-), along with significant decreases in the isocyanate peaks [4]. In addition, the FTIR spectra of the TiO_2/PU and 6 % Ag-TiO_2/PU showed peaks at 1,240 cm^{-1} and 970 cm^{-1}, which are typical of C-Si and Si-O-Ti bonds, respectively [5, 6]. The occurrences of these peaks indicate that the reaction between titanium tetraisopropoxide with γ-aminopropyl triethoxysilane to form amino titanosiloxane was successful. The FTIR spectra of the TiO_2/PU and 6 % Ag-TiO_2/PU also exhibited peaks of TiO_2 (Ti-O-Ti), which was formed from hydrolysis of the alkyl groups in amino titanosiloxane [7]. Thus, TiO_2 was deposited successfully on the surface of PU in both TiO_2/PU and Ag-TiO_2/PU based on bridge role of silicone, which bonds TiO_2 and PU by a C-Si-O-Ti link.

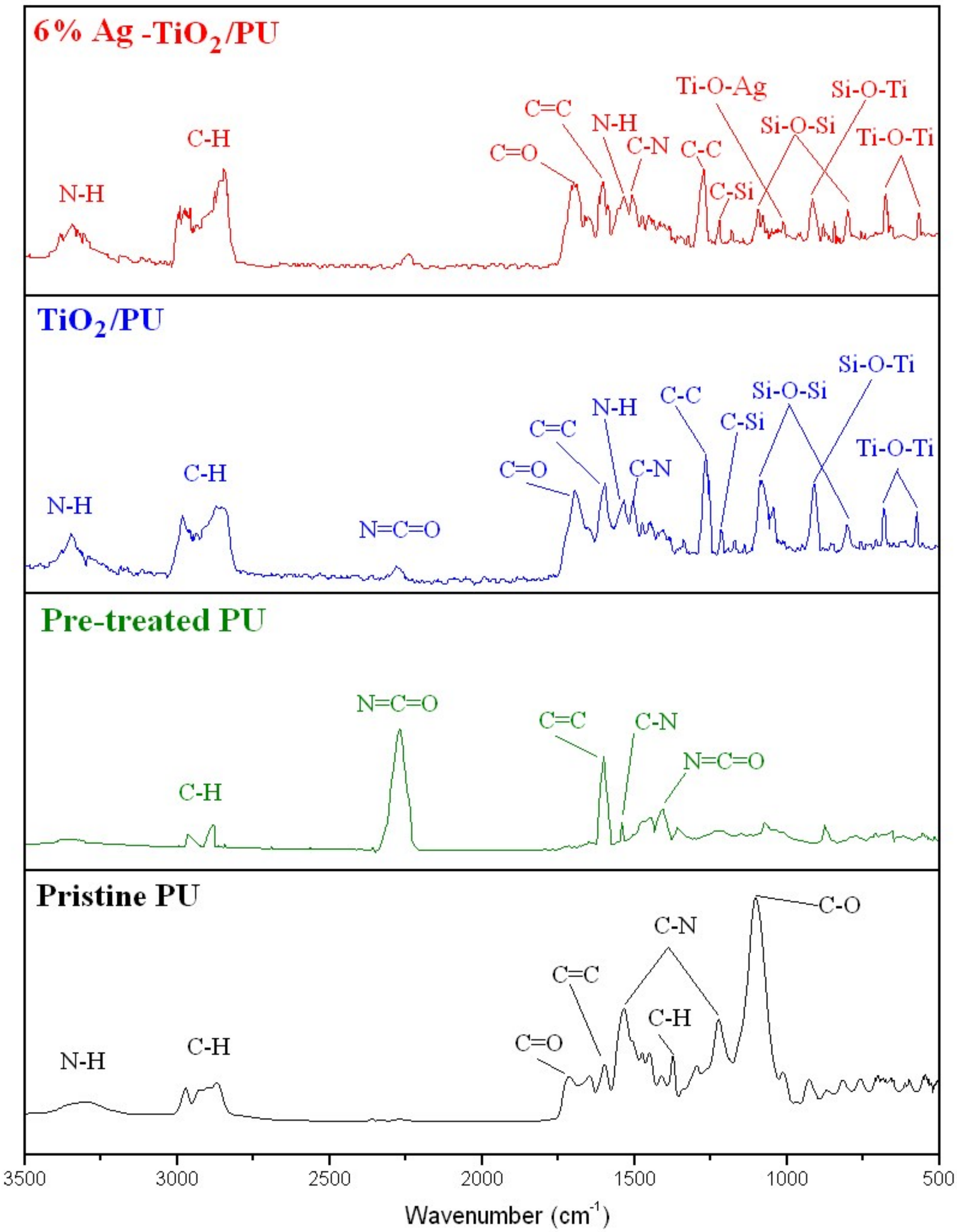

Figure S1: FTIR spectra of pristine PU, pre-treated PU, TiO_2/PU and 6 % Ag-TiO_2/PU

Reference

[1] G. Trovati, E.A. Sanches, S.C. Neto, Y.P. Mascarenhas, G.O. Chierice, Characterization of polyurethane resins by FTIR, TGA, and XRD, Journal of Applied Polymer Science, 115 (2010) 263-268.

[2] R.M. Hodlur, M.K. Rabina, Self assembled graphene layers on polyurethane foam as a highly pressure sensitive conducting composite, Composites Science and Technology, 90 (2014) 160-165.

[3] U. Sebenik, M. Krajnc, Influence of the soft segment length and content on the synthesis and properties of isocyanate-terminated urethane prepolymers, International Journal of Adhesion & Adhesives, 27 (2007) 527-535.

[4] P.A. Charpentier, K. Burgess, L. Wang, R.R. Chowdhury, A.F. Lotus, G. Moula, Nano-TiO_2/polyurethane composites for antibacterial and self-cleaning coatings, Nanotechnology, 23 (2012) 425606-425615.

[5] J. Wang, C.H. Lua, J.R. Xiong, Self-cleaning and depollution of fiber reinforced cement materials modified by neutral TiO_2/SiO_2 hydrosol photoactive coatings, Applied Surface Science, 298 (2014) 19-25.

[6] M.T. Kim, Deposition behavior of hexamethydisiloxane films based on the FTIR analysis of Si–O–Si and Si–CH_3 bonds, Thin Solid Films, 311 (1997) 157-163.

[7] Y. Wen, H. Ding, Y. Shan, Preparation and visible light photocatalytic activity of Ag/TiO_2/graphene nanocomposite, Nanoscale, 3 (2011) 4411-4418.