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# Facile Fabrication of POSS-Modified $MoS_2$/PMMA Nanocomposites with Enhanced Thermal, Mechanical and Optical Limiting Properties

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## Abstract:

A facile strategy was applied to transfer chemically exfoliated molybdenum disulphide ($MoS_2$) nanosheets from aqueous medium to organic solvents. The $MoS_2$ nanosheets were then modified by trisilanol-phenyl-POSS ($T_7$POSS) which was confirmed by Fourier transform infrared (FT-IR), X-ray photoelectron spectroscopy (XPS) and Powder X-Ray Diffraction (PXRD). The modified $MoS_2$ nanosheets were then incorporated into poly (methyl methacrylate) (PMMA) via a simple solution blending method. The Scanning Electron Microscope (SEM) and ~~Powder X-Ray Diffraction (PXRD)~~ Transmission electron microscope (TEM) were employed to demonstrate the well-dispersion of nanosheets in polymeric matrix. Compared to neat PMMA, the decomposition temperatures ($T_d$) and the half weight decomposition temperatures ($T_{half}$) of POSS-$MoS_2$/PMMA nanocomposites at nanosheets concentration of 0.2 wt% were dramatically increased by 35.2 □ and 35.3 □, respectively. ~~when the content of nanosheets reached only 0.2 wt%~~. ~~Meanwhile, according to the measurements of Dynamic Mechanical Analysis (DMA), the storage modulus at 30 □ and glass transition temperature ($T_g$) were significantly improved by 5.2 times and 6.2 □, respectively.~~ Meanwhile, according to the measurements of Dynamic Mechanical Analysis (DMA), the storage modulus at 30 □ ~~was~~ is significantly improved by 5.2 times and the glass transition temperature ($T_g$) ~~was~~ is also enhanced by 6.2□. Remarkably, POSS-$MoS_2$/PMMA nanocomposites possess low optical limiting differential transmittance $T_c$ (0.5 %), low nonlinear optical absorption onset threshold $F_{ON}$ (0.02 J·cm$^{-2}$), low optical limiting threshold $F_{OL}$ (0.4 J·cm$^{-2}$) and high nonlinear coefficient $\beta$ (297 cm·GW$^{-1}$), highlighting their vast