NANOSCALE ZIRCONIUM TUNGSTATE SYNTHESIS AND USE AS A FILLER FOR DIMENSIONAL STABILITY

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ABSTRACT

Previous research by our group has shown that addition of an isotropic negatively thermal expanding material to a polymer results in a matrix with near dimensionally stable properties. Eshelby models have shown that the morphology of the filler material can affect the overall composite coefficient of thermal expansion. Toward this end, particle shape control of zirconium tungstate (ZrW$_2$O$_8$) has been examined by an inverse micelle synthesis. Diffraction patterns clearly indicate formation of 65-100% crystalline zirconium tungstate with remaining traces of tungsten oxide (WO$_3$). Rod shaped particles having diameters of ~100-200 nanometers and lengths of one to three microns were found. The size of the resulting particles is smaller than compared to those of sol-gel processing techniques, which have also been evaluated. The details associated with the inverse micelle preparation of this filler will be reported as well as the affects of different surfactants and temperature on the particle morphology and size. Finally, the nanoscale zirconium tungstate filler was incorporated into polymer matrix and the composite coefficient of thermal expansion determined as a function of temperature.