Composites of Poly(ε-caprolactone) with Mo6S3I6 Nanowires

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There has been an intense interest in the development of electrically conducting polymers for electronic applications. Among the most exciting applications are electromagnetic interference (EMI) shielding and flexible electronic substrates. Molybdenum sulphur iodine (MoSI) nanowires are electrically conducting nanofillers[1] and have monodisperse properties. Many research publications over the past few years have focussed on improving dispersibility of carbon nanotubes (CNTs) in polymer matrices. Here we report the preparation and characterisation of PCL-Mo6S3I6 composites prepared by twin screw compounding with 0.05, 0.1, 0.3, 0.5, 1, 3, 5wt% Mo6S3I6. Tensile strength and elongation at break decreased by up to 30%, particularly with higher Mo6S3I6 loading, due to the presence of agglomerations, observed by field emission scanning electron microscopy (FESEM). However, One Way ANOVA analysis showed statistically that the Young's moduli of PCL was unaffected by Mo6S3I6 addition. Both differential scanning calorimetry (DSC) and hot stage polarising optical microscope (HSPOM) analysis confirmed the nucleation effect of Mo6S3I6 to PCL. The incorporation of Mo6S3I6 to PCL resulted a decrease in spherulite size and increased crystallisation temperature by up to 5°C. The electrical conductivity of PCL-Mo6S3I6 composites were significantly enhanced by 7 orders of magnitude and a very low percolation threshold of 0.025wt% was attained for the PCL-Mo6S3I6 system, superior than any reported polymer CNT composites using melt mixing. [1] D. Vrbanic, M. Remskar, A. Jesih, A. Mrzel, P. Umek, M. Ponikvar, B. Jancar, A. Meden, B. Novosel, S. Pejovnik, P. Venturini, J. C. Coleman, D. Mihailovic, Nanotechnology 2004, 15, 635.