

## Supplementary data

### 1. Explanation on the morphology of the blends and composites

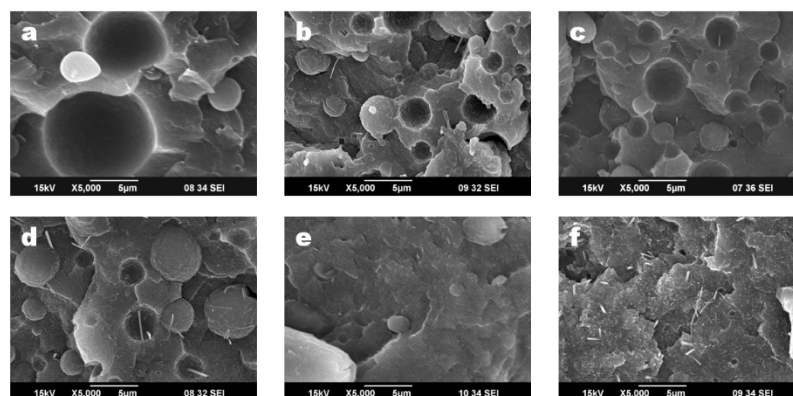
It is a well-known fact that, the polarity difference and lack of interfacial interactions between PTT and PP leads to the high interfacial tension between them and hence the blends are immiscible with droplet morphology. The addition of MWCNTs decreases the droplet size of the PP phase on account of 1) decrease of the interfacial tension 2) suppression of coalescence of PP domains by the action of MWCNT as a barrier 3) rheological reason on the predominant localization of MWCNT in the PTT phase. This can be further explained with Taylor's theory which explains the relationship between the interfacial tension, viscosity and shear rate with domain size using the equation,

$$\sigma_{\text{int}} = \frac{\eta_m \dot{\gamma} dn}{We}$$

where  $We$  is the Weber number,  $\eta_m$  is the viscosity of the matrix,  $\dot{\gamma}$  is the shear rate,  $dn$  is the average domain diameter and  $\sigma_{\text{int}}$  is the interfacial tension.

The preferential localization of MWCNTs in the PTT phase will increase the viscosity of the matrix and reduces the size of dispersed PP domains. As the domain size decreases there is increase in interfacial area between phases which results in better interfacial interaction between the phases. So this will help to improve the properties especially the mechanical properties. Composites with higher content of PTT show maximum properties due to the selective localization of MWCNTs in the PTT phase.

Effect of change in morphology of PTT/PP blend with the addition of MWCNTs can be clearly observed from the more SEM images given below,



SEM image showing the variation in domain size with the addition of MWCNT  
a)90PTT/10PPb)90PTT/10PP/0.25wt%MWCNTc)90PTT/10PP/0.5wt%MWCNTd)90PTT/10PP/1wt%MWCNT e)90PTT/10PP/2.5wt%MWCNT f) 90PTT/10PP/5wt%MWCNT

#### Reference

- 1.George, Snoopy, et al. "Rheological behaviour of thermoplastic elastomers from polypropylene/acrylonitrile–butadiene rubber blends: effect of blend ratio, reactive compatibilization and dynamic vulcanization." *Polymer* 40.15 (1999): 4325-4344.
- 2.George, Snoopy, et al. "Blends of isotactic polypropylene and nitrile rubber: morphology, mechanical properties and compatibilization." *Polymer* 36.23 (1995): 4405-4416.

S2. The term “degree of entanglement  $\phi$ ” for the MWCNTs

The entanglement is the term commonly used in the case of polymer-polymer interactions or polymer-filler interactions. When the filler is carbon nanotube, they have a special feature to get self-entangled. This self-entanglement results in the enhanced mechanical strength. The degree of entanglement between CNTs can be quantified using three parameters, such as nodal density, bundle density and total entanglement density, where the total CNT nodal density was calculated by multiplying the CNT density by the node density per CNT. The nodal density is indicated by the average areal fraction of CNTs, contributing to node formation, which can be calculated through dividing the total area of nodes connected to a single CNT by the total area of a single CNT. Bundle density was calculated following a similar method (total area of bundles connected to a single CNT/area of a single CNT), whereas the entanglement density is defined as the summation of nodal and bundle densities, describing the total degree of entanglement between the CNTs. As per the references given, as the viscosity increases, the CNT-CNT entanglement increases. The degree of entanglement of CNTs can be quantified only when studied under HRTEM of the bundles. But here in this manuscript, we have not performed the such studies on CNTs alone.

We have adopted an easier method to find the entanglement density and degree of entanglement of polymers by considering the following references.

1. J. Jyoti, B.P. Singh, A.K. Arya, S. Dhakate, Dynamic mechanical properties of multiwall carbon nanotube reinforced ABS composites and their correlation with entanglement density, adhesion, reinforcement and C factor, *RSC Advances*, 6 (2016) 3997-4006.

2. Zachariah Oommen; G. Groeninckx; Sabu Thomas (2000). Dynamic mechanical and thermal properties of physically compatibilized natural rubber/poly(methyl methacrylate) blends by the addition of natural rubber-*graft*- poly(methyl methacrylate). , 38(4), 525–536. doi:10.1002/(sici)1099-0488(20000215)38:4<525::aid-polb4>3.0.co;2-t