

## Compounding of Carbon Nanotube (CNT) with Polycarbonate

### Abstract

Polycarbonate (PC) composites were processed with multi walled carbon nanotubes (MWCNT) 15 wt.% using twin-screw extruder (L/D=52) Omega 40 H with Fraction geometry technology. Extruded PC/CNT 15 wt. % compounded pellets were further diluted to CNT 2, 3,4 and 5 wt.% with PC pellets and fabricated using Injection molding to perform Mechanical and electrical properties.

### Introduction

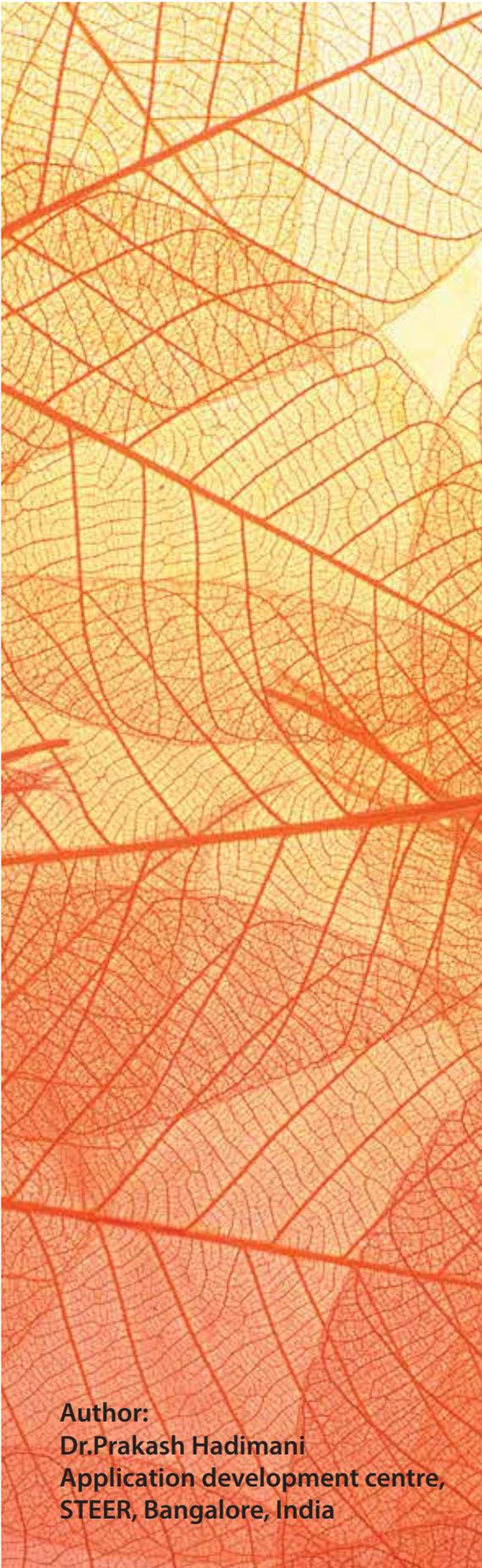
Carbon nanotubes are graphite sheets rolled into seamless tubes with diameters of just some nanometers and length up to centimeters. Nanotubes has high modulus and electrical/thermal conductivity.

The process challenges of CNT is to disperse (exfoliate) thoroughly in the polymer matrix. The CNT particles are under a cloud of being potentially hazardous to health, the safe handling and avoidance of CNT dust is more than important.

Polycarbonate is a colorless amorphous engineering thermoplastic with high impact resistance (which remains high down to -40 °C) and good dimensional stability. Polycarbonate has poor wear and fatigue properties. Applications of PC include medical apparatus (sterilizable), kitchenware (microwaveable), light fittings, lenses, safety shields, and glazing.

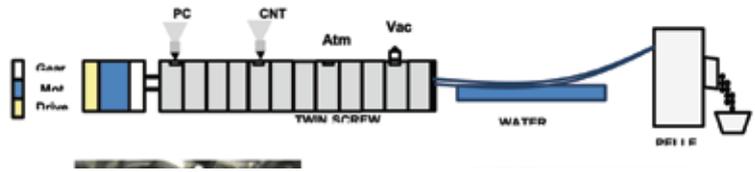
Twin-screw extrusion is the most realistic of production scale up and commercialization of these composites. Extrusion process variables (Dispersion and Distribution of CNT/PC) affect the morphology, surface resistivity and mechanical properties of the composites. Injection molding is secondary process to fabricate the final part with desired functionality.

The electrical properties are dependent on the type of CNT, their synthesis method, aspect ratio, nature of surface fictionalization, type of polymer, melt viscosity, dispersion method, and composite processing methodology.



**Author:**  
Dr.Prakash Hadimani  
Application development centre,  
STEER, Bangalore, India

## Extrusion Process



PC/CNT 15 wt. % pellets



PC/CNT 3 wt. %

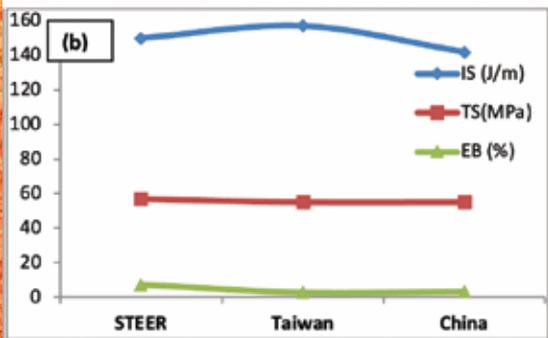
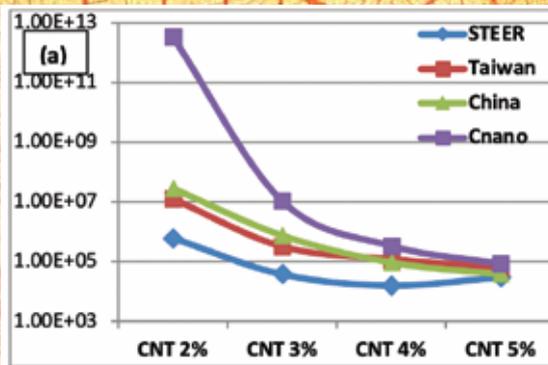


Figure 1: Surface resistivity and Mechanical properties of PC/CNT compound.

## Results and Discussions:

The conductivity of PC is improved, which is evident with addition of 2, 3, 4 and 5 wt.% concentration of MWCNT/ PC-MB and processed using FGT screw design. This is the indication of better dispersion of MWCNT in PC Matrix. Concentration of CNT increase with decrease in surface resistivity as showed in Figure 1(a). PC/CNT 2wt. % showed (Figure 1(b)) higher tensile strength and elongation at break compared to other samples

### Conclusion

Omega FGT technology showed highest electrical conductivity for PC/CNT 2,3 and 4 wt.% specimen (lower surface resistivity) compared to other samples.

FGT technology showed highest elongation at break and tensile strength compared to other samples.

Author:

Dr.Prakash Hadimani

Application development centre,  
STEER, Bangalore, India