# Electrical resistance of CNT-peek composites under temperature and compression

**Mohammad Mohiuddin**, S. V. Hoa

Concordia Centre for Composites, Department of Mechanical and Industrial Engineering, Concordia University, 1455 de Maisonneuve Blvd. W Montréal, Québec, Canada H3G 1M8
E-mail: moh_mohi@encs.concordia.ca, hoasuon@alcor.concordia.ca

## ABSTRACT

Electrically conductive carbon nano tube composites have attracted a great deal of scientific and industrial interest in the last few years. The electrical conductivity of the nanotube filled polymer composites is due to continuous conductive network formed in a specific arrangement by the nanotubes [1]. Enhancement of electrical conductivity of polymer by mixing them with multiwalled carbon nanotubes has found significant applications in newer areas such as electrostatic charge dissipation, electronic equipment, pressure sensors, sensor of vehicle weight to collect tolls in the highways, selective gas sensors, important strategic materials such as EMI/RFI shielding in computer and cellular phone housing etc. [2-4]. Smart materials can identify a change in the environment and respond to it by performing both sensing and actuation.

The level of electrical conductivity in the heterogeneous polymer nanocomposites primarily depends on several factors such as nature of the polymer matrix, morphology of conducting filler materials, processing parameters such as mixing time, mixing temperature and speed of mixing device and the test conditions such as pressure and temperature [5]. The electrical resistance of conductive polymeric composites changes with externally applied heat and pressure [6]. Scanning of literature shows that most of the researchers so far explored the applicability of pressure sensors made of carbon black (CB), carbon fiber, carbon nanotube (CNT), metallic powders, graphite etc. as conducting element and elastomeric rubber materials like NBR, SBR, EPDM etc. as matrix [7-10]. Results of those researches in engineering practice still need to be improved or adjusted according to the specific requirements of the sensor applications. No extensive research has yet been done to find out the possibility of using advanced thermoplastic materials e.g. PEEK, PEKK, PMMA as matrix in manufacturing pressure sensing element.

In the present article, the temperature and pressure dependent electrical resistance of advanced thermoplastic composites made of MWCNT and Poly Ether Ether Ketone (PEEK) for different CNT loadings are investigated. Different weight percentages of carbon nano tubes were dispersed with PEEK through intense shear mixing by calendering technique in Brabender at 100 rpm and 380°C for 20 minutes. The resulting nanocomposites were processed into round shaped pieces of 25.4 mm diameter and 1.5 mm thickness. The samples are then simultaneously compressed by applying a pressure from zero to 40 MPa with an interval of 2 MPa and heated from 40°C to 140°C at an interval of 10°C. It has been found that electrical resistance decreases significantly with the application of heat and pressure. The results are graphically represented and supported by SEM images of the sample before and after applying pressure and temperature.

*Keywords: Compression Pressure, Carbon nanotubes, electrical conductivity, micro structure.*

## References

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**Figures**

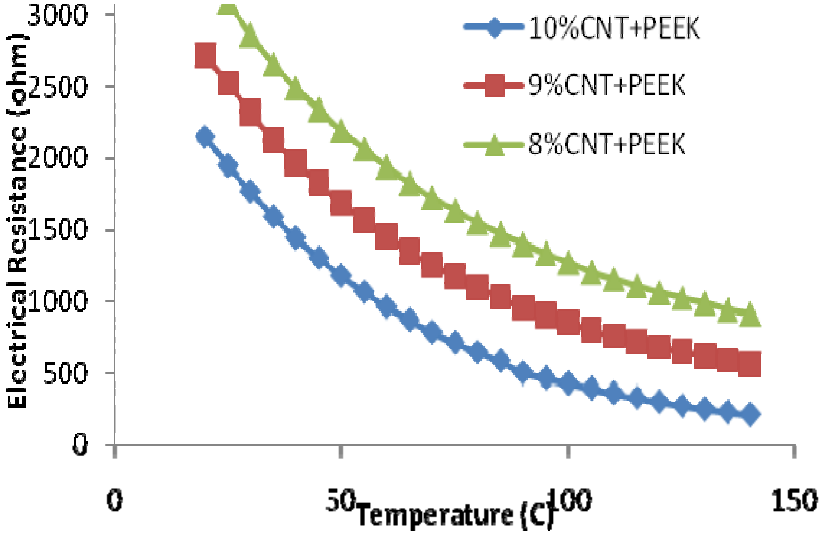


Figure 1: Electrical Resistance as a function of Temperature for 8%, 9% & 10% CNT-PEEK composites

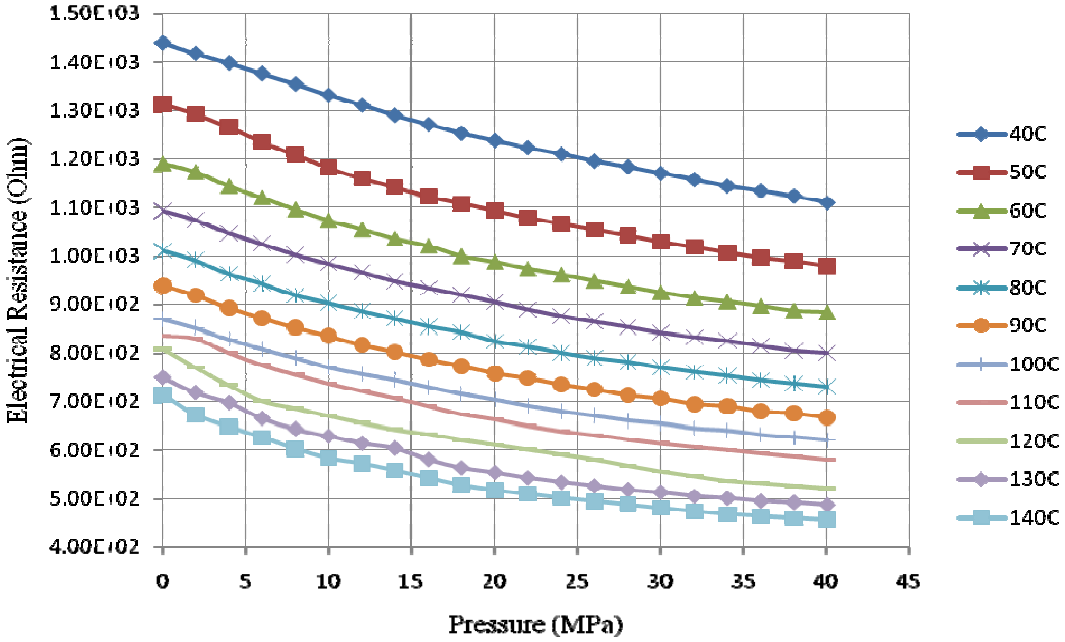


Figure 2: Electrical resistance of 9%CNT-PEEK at different temperatures and pressures