

## THE SYNTHESIS OF CARBON NANOTUBE/THERMOPLASTIC COMPOSITES

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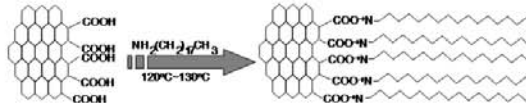
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### OBJECTIVES

- To investigate the effects of carbon nanotubes(CNT) on thermoplastic composites.
- To synthesize CNT/thermoplastic composites to improve dispersion and properties.
- To explore use of CNT/thermoplastic mixture as a binder in manufacturing.

### BACKGROUND

- During oxidation of CNT,carboxylic acid group is attached to its ends.
- The carboxylic acid group of the shortened (100-300 nm) CNT is modified with an organic material.

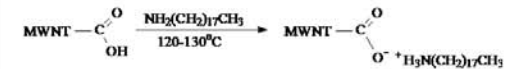


Reaction mechanism of CNT's with organic material

- The modified CNT containing the organic-material is allowed to react with polymer materials.

### PROCEDURE

- Oxidize CNT with nitric acid and sulfuric acid mixture.
- Modify the oxidized CNT with a swelling agent at 120-130°C for 72hours.



- Remove excessive organic material through sonication and washing.
- Prepare primary CNT/HDPE compound by solution method.
- Carry out melt mixing of the compound with HDPE resin for formation of the thermoplastic nanocomposite.

### PUNCH TEST



Punch tester

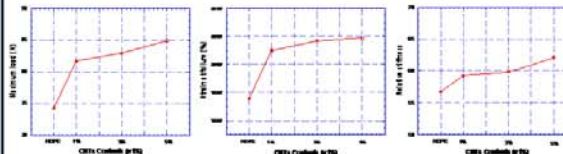
- Prepare rectangular 0.4 mm film using hot press.
- Cut test samples with 6.4 mm diameter using circular punch.
- Punch tests at the speed of 0.5 mm/min.
- Perform 10 repeated tests under selected test conditions.
- Record load and displacement values.



Before the test.

After the test.

### EXPERIMENTAL RESULTS



- Maximum load of CNT/HDPE composite increases with increasing content of CNT.
- The strain at failure increases slightly for CNT composites.
- Relative stiffness increases with increasing content of CNT.

### CONCLUSIONS

- Mechanical properties of CNT/HDPE composites increase with increasing CNT content.

### FUTURE WORK

- Observe micro-morphologies of the nanocomposite using TEM and SEM.
- Investigate the physical properties using DMA, TGA, and DSC.
- Verify chemical interaction between the CNT and functional groups.
- Perform fracture tests for the CNT/thermoplastic binder.

### ACKNOWLEDGEMENTS

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