

Ref: EPOCYL™ Mechanism of reinforcement –3 march 2009 - V01

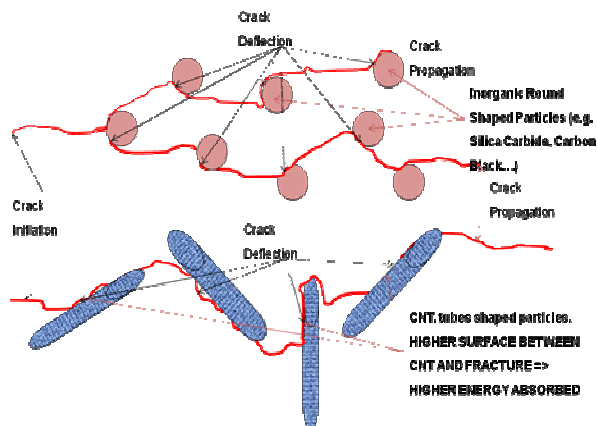
EPOCYL™ PRODUCT RANGE- MECHANISM OF REINFORCEMENT

Description

EPOCYL™ Product range is a full portfolio of epoxy resins reinforced with Carbon nanotubes in order to increase mechanical performance and electrical conductivity.

Mechanism for fracture toughness improvement:

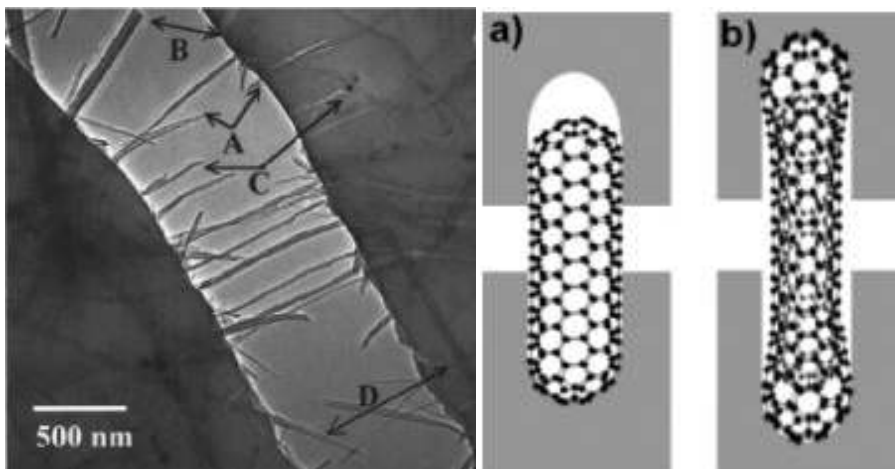
Crack inside composite materials, when located in the matrix, generally propagate in this continuous medium. One common solution to improve the resistance to that type of failure is to “insert” particles, randomly dispersed inside the material in order to lay several obstacles on the path of the crack. When the crack “encounters” such obstacles, it is energy consuming for it to go around this particle and to generate some void around it.



When the particle is not spherical anymore but cylindrical, the surface of interaction between the particle and the matrix is more important. It is then more energy consuming for the crack to generate some voids around these particles. The particles being on the nanoscale, the chances that the crack encounters them is also statistically higher. This results in a tougher material in which dissipated energy for crack propagation is significantly higher than in conventional materials.

The mechanism described above is acting in synergy with another toughening mechanism.

The carbon nanotubes that are integrated into EPOCYL™ products have very good surface interactions with the matrix itself. When the nanotubes are located on the crack path, they can contribute to reinforce the material via the mechanism called “Crack Bridging”. This means that both ends of the nanotubes are stuck to the matrix. Taking them out the matrix requires some more energy and then renders the material even tougher.



On the left: Fracture mechanisms in nanotube-based composites [Shaffer et al. *Advanced Materials* 1999;11(11):937–41]
 On the right: Potential toughening mechanisms of CNTs [Gojny et al. *Compos Sci Technol* 2005;65:2300–13.].

Important

All information is believed to be accurate but is given without acceptance of liability. Users should make their own assessment of the suitability of any product for the purposes required.