Modeling Stiffness of polymer/clay nanocomposites

K. Hbaieb[1]*, Q. Wang[2], Y. H. J. Chia[1], B. Cotterell[1]
[1]*Institute of Materials Research and Engineering (IMRE), 3 Research Link, Singapore 117 602*
[2]*Institute of High Performance Computing (IHPC), 1 Science Park Road, #01-01 The Capricorn, Singapore Science Park II, Singapore 117528*
**Corresponding author, Tel.: +65-6874-7168, fax: +65-6774-4657*

E-mail address: hb-kais@imre.a-star.edu.sg (k. Hbaieb)

Two dimensional and three dimensional finite element simulations of the stiffness of polymer/clay nanocomposite are carried out for aligned and randomly oriented particle distribution. The finite element results are compared against each other and against Mori-Tanaka analytical results. Unless for high volume fraction, the Mori-Tanaka model is well suited in predicting the stiffness of nanocomposites reinforced with a distribution of aligned particles. The prediction of the stiffness by the three dimensional finite element model is consistently higher than that of the two dimensional finite element model and the difference between both results increases with increasing volume fraction. For the random distribution of particles, the Mori-Tanaka model predicts well the stiffness for very low volume fraction (<1%), however, it overestimates the stiffness for higher volume fraction.

Keywords: Finite element model, Mori-Tanaka model, nanocomposites.