

Nanocomposite Fire Retardants Dramatically Improve Fire Safety

Supporting/Contributing Agencies: NIST

NIST has demonstrated that nanocomposites have excellent fire retardant properties, providing consumers with new, environmentally-safe products that dramatically improve fire safety. Since the 1990's US industry has been under increasing international pressure to remove halogenated flame retardants from products because of their potential hazard to the environment. Because of the high cost of fire to the economy—estimated to be at least \$160 B in 2006 and growing—new, non-toxic yet highly effective retardants are urgently needed, especially for polymer-based products such as plastics. NIST established that nanoparticles, including clay, carbon nanotubes, and double layered hydroxides, can be used to reduce the flammability of polymers. Focusing on non-toxic clay nanocomposites, NIST determined the effects of the dispersion, aspect ratio, shape, concentration, and surface treatment of the nanoparticles on the flammability of polymers. The nanoparticles produce a protective nano-reinforced insulating layer on the surface of a burning polymer that prevents dripping, and only require one tenth the amount of additive compared with other non-halogenated flame retardants. This technology is now in use in commercial flame retardant products, representing one of the first new fire retardant technologies commercially-available in decades.

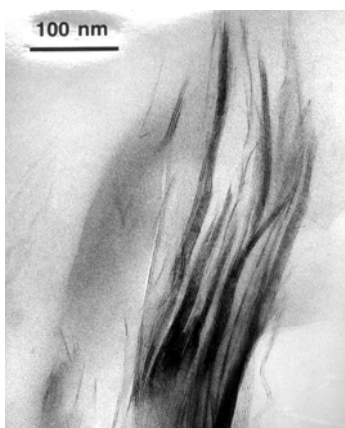


Figure 1. Transmission electron microscopy image of 1 nm-thick Montmorillonite clay sheets dispersed in a polymer matrix.

References/Publications/Patents

Gilman, J. W. Jackson, C. L. Morgan, A. B. Harris, Jr., R. Manias, E. Giannelis, E. P. Wuthenow, M. Hilton, D. Phillips, S. Flammability properties of polymer-layered-silicate nanocomposites, polypropylene and polystyrene nanocomposites. *Chem Mater.***12**, 1866 (2000).

Gilman, J. W., Harris Jr., R. H., Shields, J. R., Kashiwagi, T., Morgan, A. B., A study of the flammability reduction mechanism of polystyrene-layered silicate nanocomposite: layered silicate reinforced carbonaceous char, *Polymers for Advanced Technologies*, **17**, 263-271 (2006).

Product web sites: <http://www.nanoclay.com/>, and <http://www.nanocor.com/consumer.asp>.