Effect of Mixing Method on Thermal Properties of Silicone Composites

Ryan J. Gerakopulos, Chitral J. Angammana, and Shesha H. Jayaram
University of Waterloo, Canada
e-mail: cangammana@gmail.com

***Abstract*— One of the major challenges encountered when dispersing nano and/or micro particles (fillers) in a polymer matrix is achieving satisfactory dispersion quality (i.e., filler distribution in the polymer matrix). Very small size particles, especially in the nano-scale range, generally tend to agglomerate due to their surface energy arising from Van der Waals forces, making agglomerations difficult to breakup. Breaking these agglomerations is even more difficult in a polymer matrix due to the higher viscosity of polymers compared to the lower viscosity liquids. However, better dispersion and lower degree of agglomerated particles (i.e., agglomeration occurrence and size) is needed to achieve desired specific properties of a final composite material. For the present investigation, the results presented here demonstrate the effect of distinct dispersion methods on aggregate physical properties of a filled composite. Composite samples were prepared using two different mixing techniques: (1) conventional high shear mixing, and (2) a novel dispersion method that exploits unique dispersion mechanisms. It is known that composites prepared with distinctly different mixing techniques exhibit different aggregate physical properties as a consequence of differences in filler microstructures. For instance, with an increasing degree of filler dispersion at high filler loading levels, it is understood that agglomerated structures (e.g., large aggregated groups, flocs, or networks) can be broken down into small structures or even individual isolated particles in the polymer matrix.**