

MAR12-2011-000919

Abstract for an Invited Paper
for the MAR12 Meeting of
the American Physical Society

The Development of Filler Structure in Colloidal Silica – Polymer Nanocomposites

JEFFREY METH, E.I. Dupont de Nemours & Co., Inc.

The realization of the full potential for polymeric nanocomposites to manifest their entitled property improvements relies, for some properties, on the ability to achieve maximum particle-matrix interfacial area. Well-dispersed nanocomposites incorporating colloidal silica as the filler can be realized in both polystyrene and poly(methylmethacrylate) matrices by exploiting the charge stabilized nature of silica in nonaqueous solvents which act as Bronsted bases. We demonstrate that dispersions of colloidal silica in dimethylformamide are charge stabilized, regardless of organosilyl surface functionalization. When formulated with polymer solutions, the charge stabilized structure is maintained during drying until the charged double layer collapses. Although particles are free to diffuse and cluster after this neutralization, increased matrix viscosity retards the kinetics. We demonstrate how high molecular weight polymers assist in immobilizing the structure of the silica to produce well-dispersed composites. The glass transition temperatures of these composites do not vary, even at loadings up to 50 v%.