# Rheology and Microstructure of Colloidal ZnO Nanoparticles Suspended in a Viscoelastic Surfactant Mixture

Paloma Pimenta*, Eugene E. Pashkovski ♣

*Colgate Palmolive Company, R&D
Technology Center, 909 River Road, PO Box
1343, Piscataway, NJ 08855-1343, USA

The rheology and microstructure of a colloidal system composed of zinc oxide nanoparticles suspended in a semi-dilute anionic-zwitterionic surfactant mixture (sodium dodecyl sulfate/laurylamidopropyl betaine) have been systematically investigated. In this particular mixture, the surfactants form an entangled worm-like micellar networks that display a very complex and rich rheological behavior which makes them very attractive to the consumer products, pharmaceutical, and cosmetic industries, among others. These systems can potentially serve as matrices for the suspension of a variety of active ingredients such as sunscreens, moisturizers, medications, and vitamins. The aggregation behavior of colloidal particles is largely dependent on the medium in which they are suspended, and the dynamics of such particles in worm-like micellar solutions has not been extensively studied to date. The dynamic properties and microstructure of the colloidal particle/micelle suspension studied here have been quantified using rheology and diffusion wave spectroscopy (DWS). Results show that the addition of ZnO nanoparticles alters the rheology of the micellar system, an indication that the particles interact with the micellar network. The diffusion of the particles within the micellar system has been quantified through the mean square displacement of particles in the micellar network, which provides information about the mobility of the particles at different timescales. From the mean square displacement, the viscoelastic moduli were calculated and are in good agreement with mechanical measurements.

**Keywords**: nanoparticles, micelles, rheology

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