MURILO TOLEDO SUEKUNI

MASTER OF SCIENCE DEFENSE

CHEMICAL ENGINEERING

Accounting for Paramagnetic Influence in Wetted Surface Area Studies of Particle Suspensions Using Solvent Relaxometry

In the science and engineering of polymer matrix composites (PMC), the specific surface area of particle fillers is a key design consideration. In this study, the characterization of Kevlar® pulp and micropulp fillers was conducted via multiple techniques with emphasis on specific surface area. Conventional techniques used in the determination of specific surface area require aggressive outgassing steps potentially at high temperatures, which can decrease the surface area of some polymeric particles. The application of time-domain nuclear magnetic resonance (NMR) to characterization of a specimen's surface area is described. A correlation between NMR relaxation rates and surface area data acquired from BET analysis of nitrogen (N_2) adsorption has been observed. The specific surface area of Kevlar® pulps was found to increase by as large as a factor of three when particle size was reduced by milling pulp materials (8 – 18 $m^2\ g^{-1}$) to micropulps (20 – 24 $m^2\ g^{-1}$). No further changes were found in the chemical structure of Kevlar® following the particle size reduction, however, trace iron (Fe) was identified in the range 11 - 2,633 ppm, which may perturb the NMR signal. To address the influence of Fe, the surface relaxivity of Kevlar® (0.7 ± 0.1 μm s^{-1}) was determined based on a linear relationship between the iron content and its perturbation of the relaxation time T_2 of the system. Lastly, the wetted specific surface area calculated from the NMR data yielded trends related to the foreseen effects of polymer drying and particle size reduction. The acquired results led to valuable insights about the use of solvent relaxation for surface characterization of polymer particles, which feature a complex structure.

Date:

Monday, August 10, 2020

Time:

Starts @ 10:00AM

Zoom Meeting Details:

https://kansas.zoom.us/j/93616870346

Meeting ID: 93616870346

Password: 726906

Committee Chair:

Associate Professor Alan Allgeier