Influence of Dispersants on Graphite-Polydimethylsiloxane Composites and Interfacial Structures

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Inorganic-organic hybrid composites consisting of ceramic particles and polymer matrix have both properties delivered from each component such as thermal or electric conductivity, mechanical strength, flexibility, adhesive, and so on, however there is the tradeoff relationship between them. Viscous composites consisting of liquid polymer commercially require low viscosity for the dispensing process performance. To address the requirement, dispersants could be potentially used for the composite. Dispersants effectively interact with filler surfaces and improve their compatibility with polymer matrix and filling-up characteristics in filler/polymer composites. At the present work, the capability of polydimethylsiloxane-based dispersants (PDMS-dispersants) having different functional groups to decrease the viscosity in Graphite/PDMS composites was evaluated. To explore the relationship with the composite macroscopic properties, the adsorption characteristics of PDMS-dispersants were investigated. Graphene substrates were used as a surface model for graphite particles. Deuterated PDMS (D-PDMS) containing PDMS-dispersants were spin-coated on the graphene substrates, and the formed interfacial layers were observed by neutron reflectometry (NR) **[1-2]** . It revealed that PDMS-dispersant segregated with a single nanometer in the graphene interface and varied structures in different functional groups and molecular weights. Pyrene-terminated PDMSs (Py-PDMSs) showed strong adsorption characteristic for the graphene, and pyrene moieties played a role to form the segregation layer whereas the dimethylsiloxane chain gave the compatibility with PDMS matrix and form the diffusion layer in the graphene interface. The interfacial structures explained that Py-PDMSs effectively decreased the viscosity in graphite/PDMS composites. This work is the first report to observe the interfacial structure in liquid PDMS/graphene by NR, and this imitative interfacial observation could be referred to a design of new polymer-based dispersants in composite uses.

Keywords:
Neutron reflectometry; interfacial structure; graphene substrate

References:

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