Phase Field Interface Modelling Of Phase Separation For Microporous Structure Fabrication

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Abstract

Microporous structures have been broadly used for a wide range of applications, such as integrated circuit packages, binders, surface coatings and filtration systems. We have developed microporous non-volatile emulsion thermosets (MiNET), a new class of composite resins made from epoxies and nanoparticles, a liquid porogen, and a small amount of surfactant. These ingredients form an intermediate between a conventional emulsion and a Pickering emulsion to create a bicontinuous network of oil and epoxy composite that is present throughout the processing. The oil phase can then be removed to leave the porous network. We are modeling the formation of these multiphase networks using the phase field method. Using free energy functional modelled interface, arbitrary intricate particle growth morphologies can be studied without any prior assumption of their shape and distribution. This study presents the application of a phase field model by using the moving interface of COMSOL Multiphysics® Mathematics Module. We considered the concept of the phase-field variables and the Cahn-Hilliard equation in 2D and 3D microstructures here by implementing the phase separation segment of COMSOL® Application Library. Transient analysis using implicit solver for different surface tension coefficient, wall contact angle, and mobility parameter are performed. The eventual model will allow us to predict the limits of materials and particle sizes that will form the MiNET phase.