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DEFORMATION, FRACTURE, AND DIFFUSION IN SOLIDS: FORMULATION OF CONTINUUM THEORIES

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Multicomponent materials such as polymer gels, interstitial solid solutions and intercalation compounds have in common the nature of their constituents: they are composed of a deformable host solid of fixed composition and mobile guest species that can enter into, move through, and accumulate within the interstices of the host solid. These materials have definite shape inherited from the host component and variable composition since the amount of guest species within the host solid can change. Therefore, modeling the behavior of this type of material body requires a proper treatment of mechanical and chemical phenomena brought about by changes of shape and composition, including the incorporation of host-guest interactions. The situation becomes still more complicated when the phenomenon of fracture is involved.

Motivated by the foregoing remarks, we explore how modern continuum mechanics can be used as a framework to formulate coupled theories for deformation, fracture and species migration in multicomponent materials of the type described above. Applications will be discussed within the context of polymer gels and hydrogen diffusion in solids.

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