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Elasticity dominated surface segregation of small molecules in polymer mixtures SALVATORE CROCE, Durham University, JAROSLAW KRAWCZYK, Durham University, Lodz University of Technology, TOM MCLEISH, BUDDHAPRIYA CHAKRABARTI, Durham University — When a binary polymer mixture with mobile components is left to equilibrate, the low molecular weight component migrates to the free surface. A balance between loss of translational entropy and gain in surface energy dictates the equilibrium partitioning ratio and the migrant fraction. Despite its ubiquity and several theoretical and experimental investigations, the phenomenon is not fully understood. Further, methods by which migration can be controlled are in its nascent stage of development. We propose a new phenomenological free energy functional that incorporates the elasticity of bulk polymer mixtures (reticulated networks and gels) and show (using mean field and self-consistent field theories) that the migrant fraction decreases with increasing the bulk modulus of the system. Further, a wetting transition observed otherwise for large values of miscibility parameter and polymerization index can be avoided by increasing the elastic modulus of the system. Estimated values of moduli (for the effect to be observable) are akin to those of rubbery polymers. Our work paves the way for controlling surface migration in complex industrial formulations with polymeric ingredients where this effect leads to decreased product stability and performance.

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