

Homework 8 Advanced Thermodynamics
Due Tuesday October 20, 2020

Polymer recycling involves mixed streams of immiscible polymers. These materials can be used to make synthetic wood and, in some cases, can be used as additives in various extrusion processes such as in formation of films and plastic parts. Virgilio N; Desjardins P; L'Esperance G; Favis BD *In Situ Measure of Interfacial Tensions in Ternary and Quaternary Immiscible Polymer Blends Demonstrating Partial Wetting* *Macromolecules* **42** 7518-7529 (2009) studied mixtures of many of the major polymers to determine the structure that results on mixing.

- a) Explain what the spreading coefficient is and how it could be used to determine compatibility and usefulness of a particular ternary mixture of immiscible polymers. Explain the logic behind equation (1) for this purpose. Consider Figure 1 and explain the logic behind the four cases.
- b) Figure 2 shows three contact angles at a ternary blend interface. Use the description of contact angle in the notes and in the book to explain how the contact angle and surface tensions are related in Figure 2.
- c) Explain the Neumann triangle and the Neumann equation mentioned on page 7519 of Virgilio. (https://en.wikipedia.org/wiki/Ideal_surface)
- d) Explain the breaking thread method to determine interfacial tension. (Elemans PHM; Janssen JMH; Meijer HEH *The measurement of interfacial tension in polymer/polymer systems: The breaking thread method* *J. Rheol.* **34** 1311-1325 (1990).)
- e) Figure 7 (a) and (b) of Virgilio show a situation reminiscent of a Pickering emulsion, which is a method to stabilize a dispersion in low-molecular weight fluids. Define a Pickering emulsion and explain what advantages it has for dispersion in Materials Science noting the work of Lv. (Lv H; Xing Y; CU X; Xu T; Zhang X *Construction of dendritic Janus nanomotors with H₂O₂ and NIT light dual-propulsion via a Pickering emulsion* *Soft Matter* **16** 4961-4968 (2020).)