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Mesoscale inhomogeneities in an aqueous ternary system DEEPA SUBRAMANIAN, STEPHEN HAYWARD, ELIA ALTABET, Department of Chemical and Biomolecular Engineering, University of Maryland, College Park, MD 20742, PETER COLLINGS, Department of Physics and Astronomy, Swarthmore College, Swarthmore, PA 19081, MIKHAIL ANISIMOV, Department of Chemical and Biomolecular Engineering, University of Maryland, College Park, MD 20742 — Aqueous solutions of certain low-molecular-weight organic compounds, such as alcohols, amines, or ethers, which are considered macroscopically homogeneous, show the presence of mysterious mesoscale inhomogeneities, order of a hundred nm in size. We have performed static and dynamic light scattering experiments in an aqueous ternary system consisting of tertiary butyl alcohol and propylene oxide. Tertiary butyl alcohol is completely soluble in water and in propylene oxide, and forms strong hydrogen bonds with water molecules. Based on results of the study, we hypothesize that the mesoscale inhomogeneities are akin to a micro phase separation, resulting from a competition between water molecules and propylene oxide molecules, wanting to be adjacent to amphiphilic tertiary butyl alcohol molecules. Coupling between two competing order parameters, super-lattice binary-alloy-like ("antiferromagnetic" type) and demixing ("ferromagnetic" type) may explain the formation of these inhomogeneities. Long-term stability investigation of this supramolecular structure has revealed that these inhomogeneities are exceptionally long-lived non-equilibrium structures that persist for weeks or even months.

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