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PEE-PEO block copolymer exchange rate between micelles is detergent and temperature activated ALLEN SCHANTZ, PATRICK SABOE, Penn State University, HEE-YOUNG LEE, Kumoh National Institute of Technology, IAN SINES, Saint Gobain, PAUL BUTLER, NIST Center for Neutron Research, KYLE BISHOP, JANNA MARANAS, MANISH KUMAR, Penn State University — We examine the kinetics of polymer chain exchange between polymer/detergent micelles, a system relevant to the synthesis of protein-containing biomimetic membranes. Although chain exchange between polymer aggregates in water is too slow to observe, adding detergent allows us to determine chain exchange rates using time-resolved small-angle neutron scattering (TR-SANS). We examine a membrane-protein-relevant, vesicle-forming ultra-short polymer, Poly(ethyl ethylene)20-Poly(ethylene oxide)18 (PEE20-PEO18). PEE20-PEO18 is solubilized in mixed micelles with the membrane-protein-compatible non-ionic detergent octyl-β-D-glucoside (OG). We show that OG activates block copolymer exchange, and obtain rate constants at two detergent concentrations above the CMC (critical micellar concentration) of OG. We find that chain exchange increases two orders of magnitude when temperature increases from 308 to 338 K, and that even a 1 mg/mL increase in OG concentration leads to a noticeable increase in exchange rate. We also calculate the activation energy for chain exchange and find that it is much higher than for lipid exchange. These findings explain the need for high detergent concentration and/or temperature to synthesize densely packed polymer/protein membranes.

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