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On the wetting, phase transitions, and diffusion of water on supported bilayer lipid membranes[1] ZACHARY BUCK, ANDREW MISKOWIEC, MIA BROWN, MENGJUN BAI, JASON COOLEY, RENEE JIJI, HASKELL TAUB, University of Missouri - Columbia, FLEMMING HANSEN, Technical University of Denmark, HELMUT KAISER, MU Research Reactor, MADHUSUDAN TYAGI, NIST Center for Neutron Research, SOULEYMANE DIALLO, EUGENE MAMONTOV, KENNETH HERWIG, Oak Ridge National Laboratory
— Temperature-dependent elastic incoherent neutron scattering shows qualitatively different freezing behavior for water associated with single bilayers of the charge-neutral DMPC (dimyristoylphosphocholine) lipid and for the anionic DMPG (dimyristoylphosphoglycerol) bilayer membrane supported on a silicon substrate. While water in the vicinity of the neutral DMPC membrane shows a major freezing transition slightly below the bulk freezing point, water near DMPG is characterized by continuous freezing to lower temperatures. Water remains mobile in the DMPG system down to 210 K in contrast to water associated with the DMPC membrane, which freezes completely at 255 K. We suggest that this behavior may be related to a film-like water structure in the DMPG case owing to the hydrophilic nature of the substrate, while most of the water in the DMPC system is bulk-like and dewets from the hydrophobic surface. Analysis of the quasielastic spectra of the DMPC system yields a diffusion constant of the membrane-associated water that decreases in a step-like fashion on cooling, indicating a second freezing transition below the one attributed to bulk-like water.

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