Abstract Submitted
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Network structure of the mussel plaque and its significance for load bearing and adhesion[1] EMMANOUELA FILIPPIDI, JUNTAE KIM, J. HERBERT WAITE, MATTHEW HELGESON, MEGAN T. VALENTINE, University of California, Santa Barbara — Marine mussels attach to rocks, each other, and a variety of surfaces via a flat, wide plaque that is interpenetrated by the collagen fibers of a thin, long thread that connects the plaque to the mussel body. The unusually strong adhesion of the plaque has long been attributed to the molecular design of its adhesive proteins that can form a variety of strong chemical bonds. However, the molecular energies for de-adhesion are orders of magnitude smaller than the macroscopic energies measured. We propose that the mesoscopic design of the plaque is critical in enhancing load bearing and eventually adhesion. We present new results on the structure of the plaque studied via electron microscopy and neutron scattering that exhibit a plaque geometry reminiscent of structural foams. Our studies reveal a collection of pores with an inner network, further connected with an outer network. The final structure can be described by two length scales. A synthetic soft system is constructed in an effort to mimic the two-lengthscale structure of the natural plaques. The structure of the native and synthetic systems is compared with the ultimate goal of evaluating the importance of the mesoscopic structure to mechanics and adhesion.

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