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Gap Dependent Rheology in *Type I* Collagen Gels[1] RICHARD AREVALO, JEFFREY URBACH, DANIEL BLAIR, Department of Physics, Georgetown University — Branched *type I* collagen fiber networks provide extracellular support in mammalian tissues. The intricate network structure can succumb to partial or complete tearing under sufficient applied strain. Under small shear strains, *in vitro* collagen gels exhibit strain-stiffening while maintaining overall network integrity. Higher shear strains lead to network failure through discrete yielding events. We perform rheology and confocal-rheology experiments to fully elucidate the strain-stiffening and yielding behavior in these highly nonlinear materials. We apply continuous shear strains to collagen gels confined within the rheometer at fixed gaps. We observe that sheared collagen in the strain-stiffening and yielding regime has an apparent modulus that is strongly dependent on the collagen thickness. Moreover, we demonstrate that network yielding is universally controlled by the ratio of the collagen thickness to the mesh size. These results have broad implications for the interpretation of rheological data of extracellular matrix proteins and for the design of biomimetic scaffolds.

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