Supporting Materials

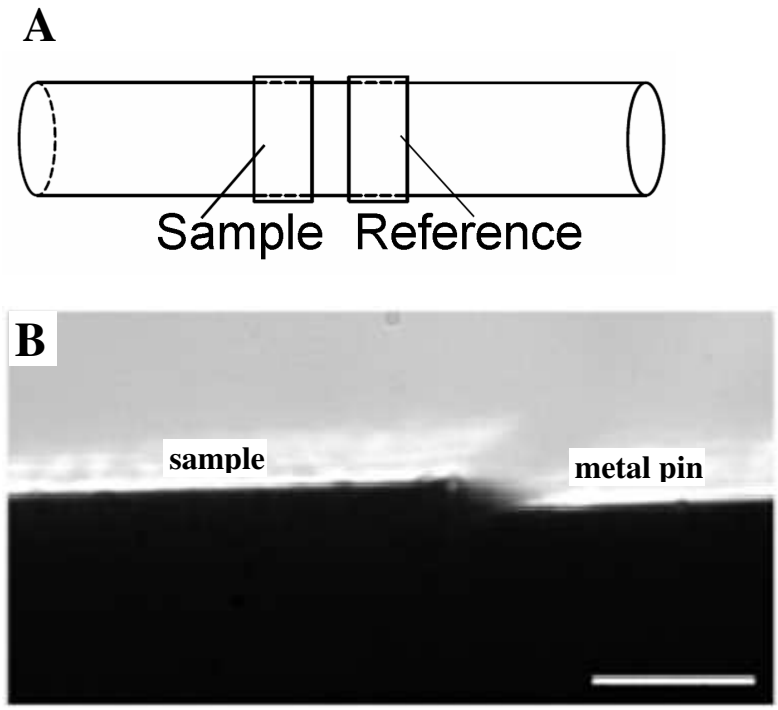

Fig. S1. (A) schematic of thickness measurement: a sample was wrapped and taped around a metal pin, and imaged from the top using optical microscopy. To verify the accuracy of thickness measurement, a referemce with a given thickness can be analyzed, following the same procedure. (B) Topview of a sample on a metal pin. Scale bar: 50 μm.

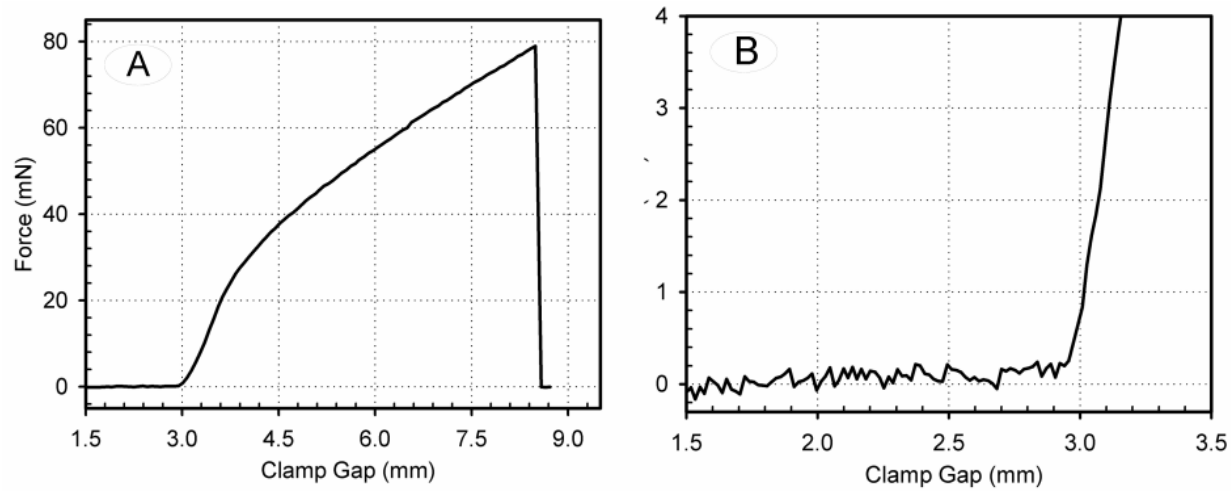

Fig. S2. A representative force-clamp gap curve (A) with a zoom-in view at samll deformations (B). The clamp gap was initially 3 mm and reduced to 1.5 mm after a sample was hydrated to

prevent any hydration-induced tension. Fig. S2B suggests that the true gauge length of samples was close to 3 mm.

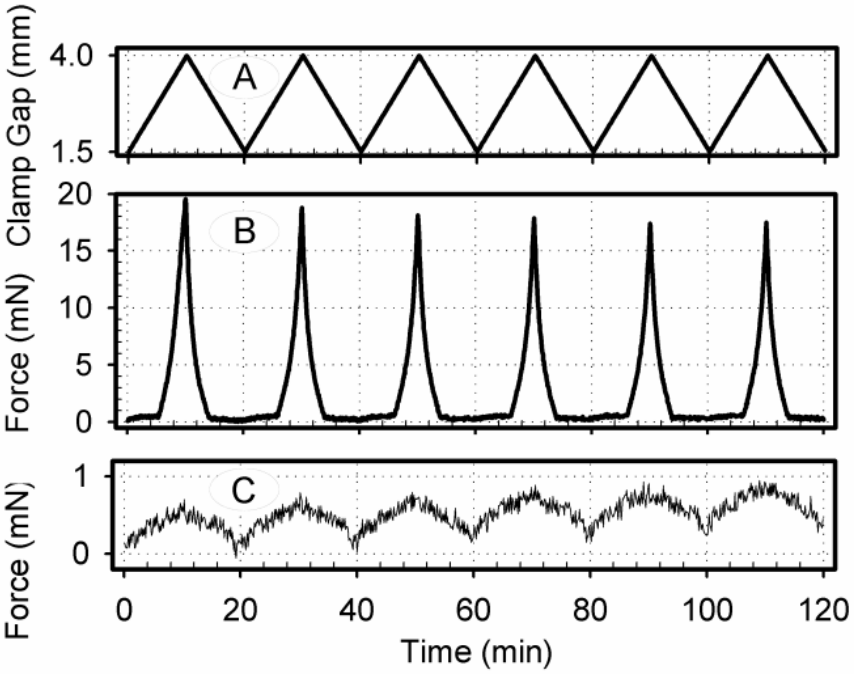

Fig. S3. Proconditioning displacement (A), force measurement (B), and resistent force exerted by the PBS on the clamp, which was measured by running the device without a sample (C). A sample of about 3 mm in length was cyclically stretched between 1.5 mm and 4.0 mm. This leads to a preconditioning strain of 33% (1 mm/3 mm), and an off-load time of about 5 to 6 minutes between loading cycles.