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Abstract Submitted
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Bottlebrush and comb-like elastomers as ultra-soft electrical and acoustically active materials¹ WILLIAM DANIEL, MOHAMMAD VATANKHAH-VARNOSFADERANI, ASHISH PANDYA, Univ of NC - Chapel Hill, JOANNA BURDYNSKA, Carnegie Mellon University - CMU, BENJAMIN MORGAN, MATTHEW EVERHART, Univ of NC - Chapel Hill, KRZYSZTOF MATYJASZEWSKI, Carnegie Mellon University - CMU, ANDREY DOBRYNIN, University of Akron- Akron, MICHAEL RUBINSTEIN, SERGEI SHEIKO, Univ of NC - Chapel Hill, UNC MIRT TEAM — Without swelling in a solvent, it is challenging to obtain materials with a modulus below 10^5 Pa, which is dictated by chain entanglements. We show that macromolecules can be disentangled by dense grafting of side chains to long polymer chains. The bottlebrush and comb-like architectures demonstrate a unique combination of flexibility and network dilution, leading to significant decrease of the entanglement modulus (G_e) and increase of extensibility. Following theoretical predictions, it has been shown that the G_e is controlled by the polymerization degrees of sidechains (n_{sc}) and grafting spacer (n_g) as $G_e \approx (n_g/n_{sc})^{1.5}$. Using the reduced entanglement density, we developed solvent-free elastomers with moduli on the order of 100 Pa and excellent extensibility. Using bottlebrush architectures we have developed PDMS dielectric actuators with high deformation at low electric field strength. Additionally strong acoustic adsorption leads to materials showing shape and volume control in light opaque environments.

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