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Chemomechanical Characterization of Autonomic Polyacrylamide Gels MATTHEW SMITH, Nanostructured and Biological Materials Branch, AFRL, WPAFB, OH, KEVIN HEITFELD, Renegade Materials Corporation, RYAN KRAMB, MAXIM TCHOUL, DANIEL GALLAGHER, RICHARD VAIA, Nanostructured and Biological Materials Branch, AFRL, WPAFB, OH — Autonomic behavior is a distinctive attribute of complex biological systems. Like biological tissue, self-oscillating hydrogels driven by the Belousov-Zhabotinsky (BZ) reaction can convert chemical signals into a mechanical response. Under appropriate conditions BZ gels exhibit sustained mechanical swell-deswell oscillations; and arrays of these gels have the potential to form networks of coupled oscillators. One of the key challenges to developing criteria for device design and assessing practical performance limits of these materials is the need for detailed knowledge of the chemomechanical characteristics of the BZ gels at various states of autonomic behavior. Recently we developed an easily synthesized BZ gel system based on polyacrylamide. Here in, the swell-deswell amplitude, mechanical forces produced during uniform oscillations, and the chemical response to external loads are discussed in context with current poly(N-isopropylacrylamide)-based systems. These studies establish the parameter space leading to robust chemomechanical oscillations and provide an experimental foundation to refine currently available theoretical models to guide the design of autonomic materials and devices.

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