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Characterization of Mycelium-Based Leather Using Sorption-Ultrasonic Experiments

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Conventional leather is a product that has been used for millennia. Unfortunately, it suffers from a significant carbon footprint due to its livestock source and tanning (the process of converting hides to leather). In addition, there are ethical issues regarding the consumer use of animal-derived products [1,2]. To mitigate these issues, engineering sustainable bio-based leather substitutes has seen increased interest in material science over the past few years. Among the bio-based materials, mycelium, the fungal “root” of a mushroom, is one of the promising alternatives due to its tunable physico-mechanical properties [2].

Understanding the effect of humidity on leather material properties is essential to tailoring high-quality leather products. To this end, we employed a novel adsorption-ultrasonic measurement technique [3] to investigate the effects of water sorption on the elastic properties of mycelium-based leather materials. The ultrasonic pulse-transmission method was used to measure the wave speed through the materials while simultaneously measuring their adsorption isotherms. The changes in the measured longitudinal modulus during water sorption and evaporation reveal the behavior of the elasticity of the test materials (Fig 1b). Specifically, the observed irreversible change in the longitudinal modulus during the initial branch of water sorption allows to understand better how the material production process and the presence of additives affect the mechanical properties of this bio-based leather material.

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Primary author: NABIYEVA, Gunel (Dept. of Chemical and Materials Engineering, New Jersey Institute of Technology, Newark, NJ, USA)

Co-authors: KARUNARATHNE, Ashoka (Otto H. York Department of Chemical and Materials Engineering, New Jersey Institute of Technology, University Heights, Newark, NJ 07102, USA); RASMUSSEN, Christopher (Bolt Threads Inc., 2261 Market Street Suite 5447, San Francisco, CA 94114, USA); ASSEM, Naila (Bolt Threads Inc., 2261 Market Street Suite 5447, San Francisco, CA 94114, USA); BAUER, Jonathan (Bolt Threads Inc., 2261 Market Street Suite 5447, San Francisco, CA 94114, USA); Dr KHALIZOV, Alexei (Department of Chemistry and Environmental Science, New Jersey Institute of Technology, 323 Dr. Martin Luther King Jr. Blvd, Newark, NJ 07102, USA); Dr GOR, Gennady (Otto H. York Department of Chemical and Materials Engineering, New Jersey Institute of Technology, University Heights, Newark, NJ 07102, USA)

Presenter: NABIYEVA, Gunel (Dept. of Chemical and Materials Engineering, New Jersey Institute of Technology, Newark, NJ, USA)

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