**Developing real-time stress sensing applications with mechanochromic chiral liquid crystal elastomer fibers for practical use**

**Dae Seok Kim\***

*Department of Polymer Engineering, Pukyong National University, Busan, Republic of Korea*

\**Corresponding author email address: daeseok@pknu.ac.kr*

Cholesteric liquid crystal elastomer (CLCE) fibres are emerging as versatile mechanochromic materials for smart textiles, with potential applications spanning fashion, healthcare, and wearable sensors. However, their practical deployment is hindered by intrinsic mechanical hysteresis during stress relaxation, which limits responsiveness to rapid, successive deformations. In this study, we present a high-toughness, low-hysteresis mechanochromic fibre capable of detecting ultra-fast mechanical stimuli in real time.[1] By adopting a sheath–core architecture—comprising a cholesteric liquid crystal elastomer sheath and a thermoplastic elastomer (TPE) core—we fabricate composite fibres that retain the vivid structural color and strain sensitivity of CLCEs while significantly enhancing mechanical performance. The resulting fibres exhibit high tensile strength (100.9 MPa), exceptional toughness (2.7 × 10² MJ m⁻³), and ultra-fast recovery (60% strain at 49.98 cm s⁻¹), enabled by the elastic TPE core. Furthermore, we demonstrate mechanochromic fibres with tunable stiffness via core material selection, facilitating their integration into complex, dynamic environments beyond single-fibre applications. This strategy paves the way for advanced smart textiles capable of real-time, high-frequency deformation sensing.



Fig. 1 **Mechanical properties and durability of the CLCE-SC and neat CLCE fibres.** (a) Toughness and tensile strength of the CLCE-SC and neat CLCE fibres. (b) Hysteresis loops of the CLCE-SC and neat CLCE fibres elongated up to 65 % strain. (c) Tangent moduli in the unloading stage of the hysteresis loop in (b). The inset shows the enlarged section of up to 25 % strain. (d) Ultra-fast strain-relaxation cyclic tests of CLCE-SC up to 50 cycles at 3.03 and 8.33 Hz.

**Acknowledgments:** This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (RS-2024-00457165).

**References:**

[1] Y. J. Jeong *et al.* *Nat. Commun.*, **16**, 2257 (2025)