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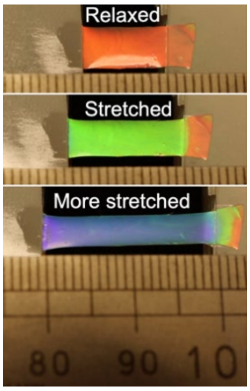

CHOLESTERIC LIQUID CRYSTAL ELASTOMERS: INTRIGUING SOFT ACTUATORS AND STRAIN SENSORS

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A lively development in today's materials science research is the creation of new 'smart' materials that respond to specific stimuli by changing their appearance or shape. Importantly, this adaptive nature is inherent to the material, rather than arising from the interaction of multiple components. This allows single elements in a garment, a construction or any other artifact to be their own actuator or sensor, while at the same time filling the basic passive function that they were designed for.
Cholesteric Liquid Crystal Elastomers (CLCEs) constitute an exciting example of smart and adaptive materials. They exhibit structural color which changes in a quantitatively predictable way in response to mechanical strain (figure). If subjected to temperature variations, they may change their shape as well as their color, but this type of response depends strongly on the distance between the operating temperature and the temperature of the latent phase transition to isotropic order. Interestingly, the act of crosslinking a cholesteric liquid crystal into a network prevents this phase transition from taking place—hence it is latent—as predicted by de Gennes more than 50 years ago but only recently confirmed experimentally.
Because the order that gives rise to the remarkable behavior of CLCEs develops by self-assembly in a liquid precursor, CLCEs can be made at low cost, in a variety of shapes, and the rubbery nature of their final state makes them easy to handle and integrate in a variety of structures. This gives them tremendous application potential across a variety of fields, for instance in structural health monitoring and warning systems that alert people in the vicinity of a structure subject to dangerous strain levels. In my talk, I will explain what CLCEs are, how they are made and how they work, as well as how they might be applied in the near future. I will focus primarily on the physics governing their self-assembly and their performance.