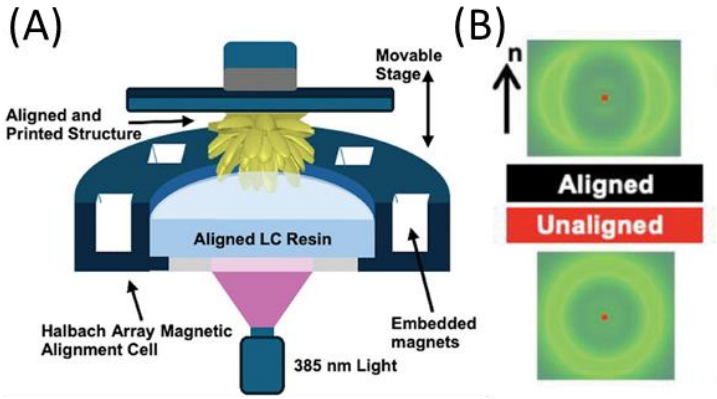
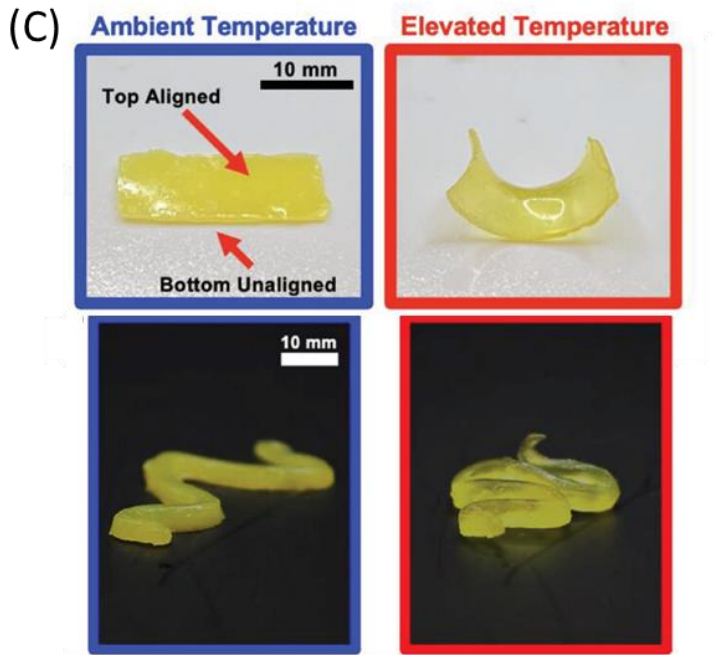
Magnetic Alignment of Vat Polymerized Liquid Crystal Elastomers





(A) A Halbach array integrated with a bottom-up DLP printer is used to define molecular alignment (B) within 3D actuators and soft robots (C).

Scientific Achievement

A novel process to 3D print aligned liquid crystal elastomers (LCEs) by integrating defined magnetic fields (Halbach arrays) into a digital light processing (DLP) vat polymerization setup.

Significance and Impact

Molecular alignment in macroscale fabrication is a considerable challenge. 3D printing of aligned LCEs provides a straightforward path to fabricate stimuli-responsive materials in form factors optimized for energy absorption and soft robotics.

Research Details

- Static magnetic fields integrated into a commercial 3D printer could be switched layer-to-layer to define complex alignments of LCE molecules.
- Mechanical characterization, wide-angle X-ray scattering, and thermal response were used to evaluate printed actuators and soft robots.

Work was performed, in part, at the Center for Integrated Nanotechnologies.

Herman, J. A.; Telles, R.; Caitlyn C. Cook, C. C.; Leguizamon, S. C.; Lewis,J. A.; Kaehr, B.; White, T. J.; Roach, D. J. "Digital Light Process 3D Printing of Magnetically Aligned Liquid Crystalline Elastomer Free–forms." *Advanced Materials* (2024)