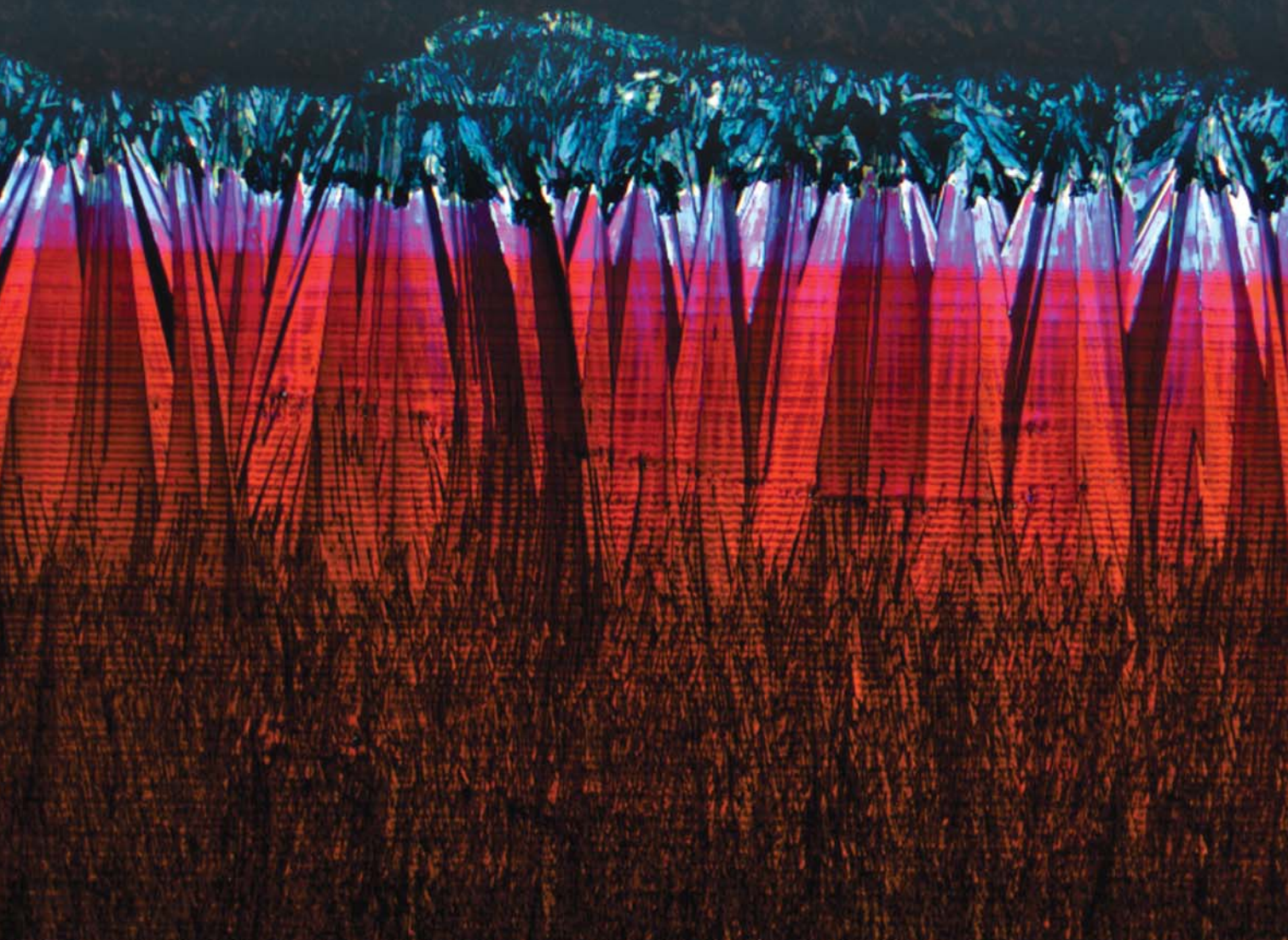




Improving organic semiconductors

Organic semiconductors hold significant promise for flexible, transparent, and cheap circuits. But they generally suffer from low current densities due to the poor mobility of the charge carriers (electrons or holes). For inorganic semiconductors, one can tune the charge transport by introducing lattice strain. Now Stanford University's Zhenan Bao and colleagues have demonstrated a way to strain organic-semiconductor films and significantly increase the charge mobility.

To introduce the strain, Bao and company deposit a solution containing the organic molecules on a heated substrate and drag a silicon wafer across the top of the solution. As the moving wafer shears the solution, the solvent evaporates at the trailing edge and the organic semiconductor molecules crystallize, locking in the strained configuration. This optical-microscope image, taken with crossed polarizers, shows a 5-mm-wide film of TIPS-pentacene that was sheared at different speeds, from 5 mm/s at the bottom to 0.01 mm/s in the middle; the top was sheared at 10 mm/s. The colors highlight the resulting crystalline texture and domain sizes. The shearing also decreased the distance between the molecules' backbones, a key factor influencing charge transport: The closer the backbones, the more the neighboring electron orbitals overlap and the higher the mobility. At high shearing speeds, the researchers found an 8% reduction in backbone spacing. And for more moderate shearing speeds, which best balanced spacing and grain size, the strain increased the mobility by up to a factor of 5 over that of unstrained films. (G. Giri et al., *Nature* **480**, 504, 2011; image by Gaurav Giri, Stanford University.)

To submit candidate images for Back Scatter, visit <http://www.physicstoday.org/backscatter.html>.