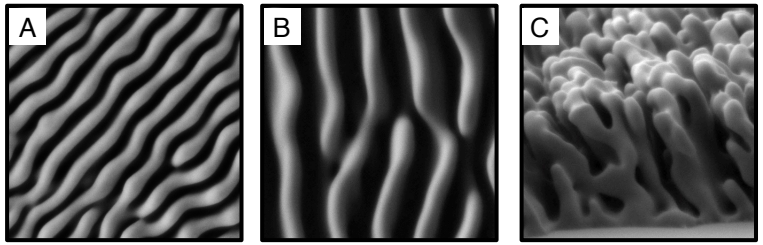
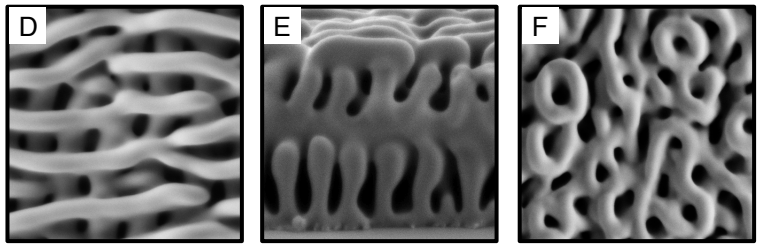
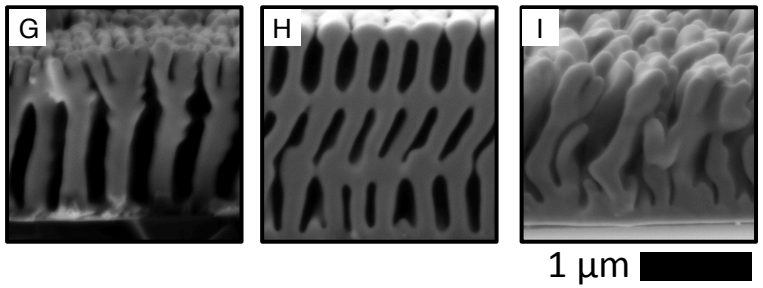
Design of 3D Mesostructures via Phototropic Growth



90° shifts (*left, middle*) or continuous rotation of polarization of incident light (*right*) create wood-pile and spiral structures



Change in illumination wavelength (*left, middle*) and incident angle (*right*) create branched and zig-zag structures



Scientific Achievement

We have developed an adaptive inorganic system that dynamically alters its emergent mesoscale morphology in response to changes in the illumination conditions.

Significance and Impact

Phototropic growth provides the ability to grow structures of entirely different geometries, periods, and directions directly on top of one another, enabling a new type of additive photolithography where 3D architectures are built up through temporal variations in the illumination conditions.

Research Details

- Spontaneous formation of mesoscale lamellar patterns during photoelectrodeposition of selenium–tellurium films
- Polarization, wavelength, and angle of incident light control the lamellae orientation, period, and growth direction, respectively, and can be dynamically altered during growth.

Work was performed at California Institute of Technology

B Sadtler, SP Burgos, NA Batara, JA Beardslee, HA Atwater, NS Lewis, ***Proc. Natl. Acad. Sci. USA*** 2013, *110*, 19707.