Butterfly wings inspire design of water-repellent surface

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Researchers mimic the many-layered nanostructure of blue mountain swallowtail wings to make a silicon wafer that traps both air and light.

The brilliant blue wings of the mountain swallowtail (*Papilio ulysses*) easily shed water because of the way ultra-tiny structures in the butterfly's wings trap air and create a cushion between water and wing.

Human engineers would like to create similarly water repellent surfaces, but past attempts at artificial air traps tended to lose their contents over time due to external perturbations. Now an international team of researchers from Sweden, the United States, and Korea has taken advantage of what might normally be considered defects in the nanomanufacturing process to create a multilayered silicon structure that traps air and holds it for longer than one year.

The researchers used an etching process to carve out micro-scale pores and sculpt tiny cones from the silicon. The team found that features of the resulting structure that might usually be considered defects, such as undercuts beneath the etching mask and scalloped surfaces, actually improved the water repellent properties of the silicon by creating a multilayered hierarchy of air traps. The intricate structure of pores, cones, bumps, and grooves also succeeded in trapping light, almost perfectly absorbing wavelengths just above the visible range.

The biologically inspired surface, described in the AIP's journal Applied Physics Letters, could find uses in electro-optical devices, infrared

imaging detectors, or chemical sensors.

More information: "Multifunctional silicon inspired by wing of male Papilio ulysses" is accepted for publication in Applied Physics Letters.

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