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Brighter Displays Come From the Wings of a Butterfly

Researchers duplicate nanostructures on butterfly wings for smaller light-based electronics

Image: iStockphoto

Biomimetics, in which nature serves as a model for devising technologies, has been a key inspiration for scientists working in nanotechnology. For instance, we've seen researchers mimic the bioluminescent light of fireflies for improved organic light emitting diodes (OLEDs). But one of the favorite insects for nanotech researchers is the butterfly. By attempting to duplicate the wing structures of butterflies, researchers have come up with an anti-counterfeiting technique and inexpensive infrared detectors.

Now researchers at the Swinburne University of Technology in Australia have again turned to the wings of a butterfly—this time, to help develop nanostructures that could lead to more compact light-based electronics that would yield brighter displays.

The Australian researchers were inspired by a particular butterfly known as the Green Hairstreak. The iridescent wings of this species—and others like it—feature intertwining patterns and curved surfaces known as gyroid structures. Gyroid structures naturally possess photonic band gaps, where photons with certain wavelengths are reflected so that the surfaces appear to be colored differently than their actual pigmentation. These photonic band gaps are analogous to energy gaps in semicondcutors. The fact that these gyroid structures have these photonic band gaps makes them potentially photonic crystals.

In research described in the journal *Science Advances*, the researchers were able to duplicate these gyroid structures using an optical two-beam lithography system with improved resolution that led to structures with better mechanical strength. This made it possible for the rearchers to not only mimic the gyroid structures of the butterfly wings, but exceed them in terms of size, controllability, and uniformity.

“These new gyroid structures could help make more compact light based electronics because, thanks to their smaller size, larger numbers of devices can be integrated onto a single chip,” said Zongsong Gan, lead author of the paper, in a press release.

“However, for three-dimensional devices, smaller and more compact also means there is a higher risk of structure collapse because of weaker mechanical strength,” said Gan. “Our fabrication technique allows us to make stronger architectures to overcome this problem.”