A great new way to paint 3-D-printed objects

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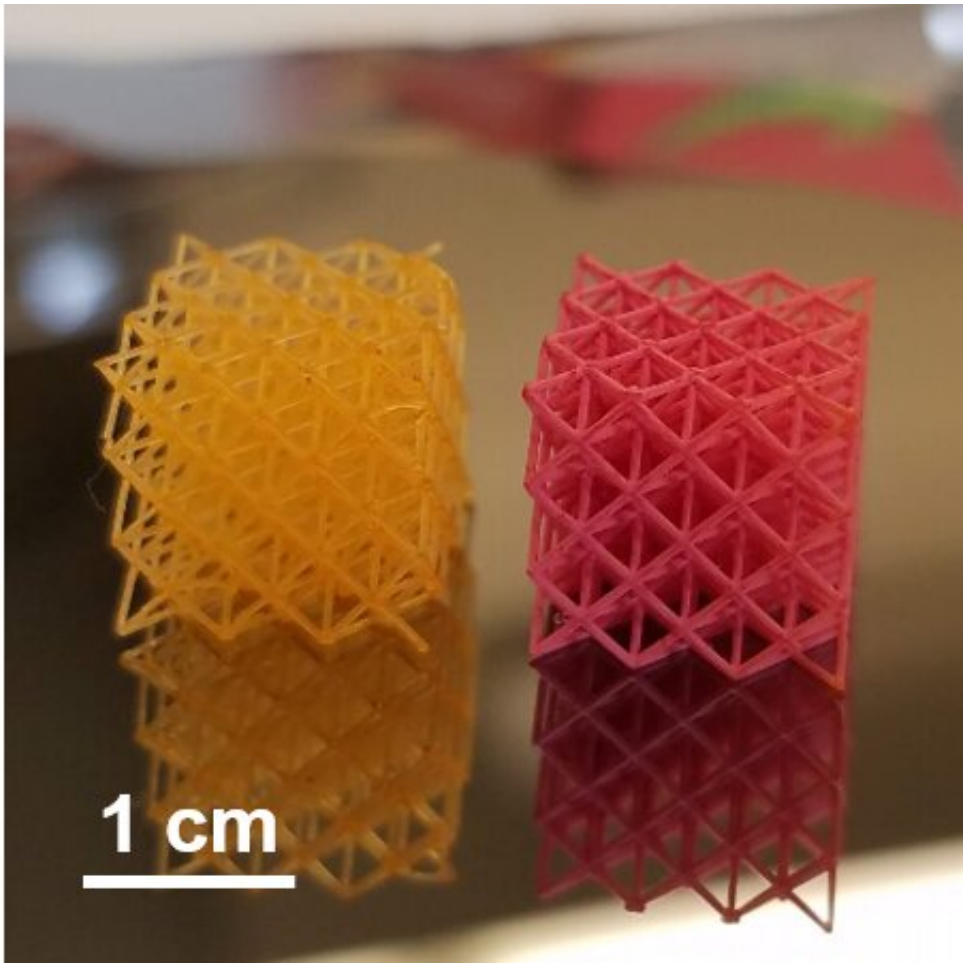

A hydrogel lattice without (left) and with (right) coating. Credit: Jonathan P. Singer/Rutgers University-New Brunswick.

Rutgers engineers have created a highly effective way to paint complex 3-D-printed objects, such as lightweight frames for aircraft and

biomedical stents, that could save manufacturers time and money and provide new opportunities to create "smart skins" for printed parts.

The findings are published in the journal *ACS Applied Materials & Interfaces*.

Conventional sprays and brushes can't reach all nooks and crannies in complex 3-D-printed objects, but the new technique coats any exposed surface and fosters rapid prototyping.

"Our technique is a more efficient way to coat not only conventional objects, but even hydrogel soft robots, and our coatings are robust enough to survive complete immersion in water and repeated swelling and de-swelling by humidity," said senior author Jonathan P. Singer, an assistant professor in the Department of Mechanical and Aerospace Engineering in the School of Engineering at Rutgers University-New Brunswick.

The engineers discovered new capabilities of a technology that creates a fine spray of droplets by applying a voltage to fluid flowing through a nozzle. This technique (electrospray deposition) has been used mainly for analytical chemistry. But in recent decades, it has also been used in lab-scale demonstrations of coatings that deliver vaccines, light-absorbing layers of solar cells and fluorescent quantum dots (tiny particles) for LED displays.

Using their approach, Rutgers engineers are building an accessory for 3-D printers that will, for the first time, allow automated coating of 3-D-printed parts with functional, protective or aesthetic layers of paint. Their technique features much thinner and better-targeted paint application, using significantly fewer materials than traditional methods. That means engineers can use cutting-edge materials, such as nanoparticles and bioactive ingredients, that would otherwise be too

costly in paints, according to Singer.

Next steps include creating surfaces that can change their properties or trigger chemical reactions to create paints that can sense their environment and report stimuli to onboard electronics. The engineers hope to commercialize their technique and create a new paradigm of rapid coating immediately after printing that complements 3-D printing.

More information: Dylan A. Kovacevich et al, Self-Limiting Electrospray Deposition for the Surface Modification of Additively Manufactured Parts, *ACS Applied Materials & Interfaces* (2020). DOI: 10.1021/acsami.9b23544

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