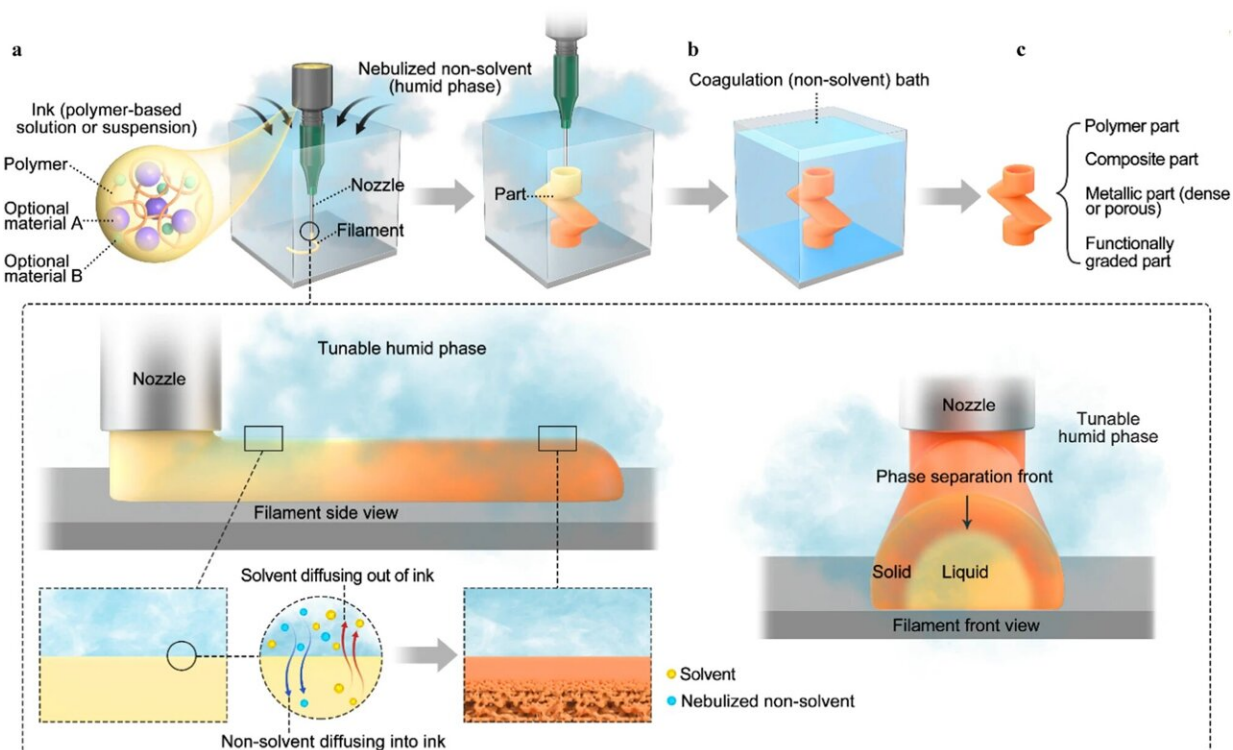


New 3D-printing method makes printing objects more affordable and eco-friendly

April 10 2024, by Karen Dooley



Schematic of VIPS-3DP process. a Printing under nebulized non-solvent from a part perspective. The inset shows a detailed view from a filament perspective: clear colors indicate material concentrations as deposited and no solidification present; darker orange colors indicate a higher solidification and stiffness degree due to solvent-vaporous non-solvent exchange dynamics, which generally results in a filament morphology with a dense outer layer and porous inner sections. b Complete solidification in coagulation bath and c versatile printed parts: polymer, composite, metallic, and functionally graded. Credit: *Nature Communications* (2024). DOI: 10.1038/s41467-024-47452-9

University of Florida engineers have developed a method for 3D printing called vapor-induced phase-separation 3D printing, or VIPS-3DP, to create single-material as well as multi-material objects. The discovery has the potential to advance the world of additive manufacturing.

Yong Huang, Ph. D., a professor in UF's department of mechanical and [aerospace engineering](#), said the [printing process](#) he and colleagues developed allows manufacturers to create custom-made objects economically and sustainably. The novel approach is [reported](#) in the journal *Nature Communications*.

"It is more economical and much simpler than current counterpart technologies," he said. "It's an affordable process for printing [advanced materials](#), including metals."

To understand the process, imagine using special eco-friendly liquids to make the "ink" for a 3D printer. These dissolvable polymer-based liquids can include metal or ceramic particles. When you print with this ink, a non-solvent vapor is released into the printing area. This vapor makes the liquid part of the ink solidify, leaving behind the solid material—called the vapor-induced phase-separation process.

Huang explained the process allows manufacturers to 3D print multi-material parts with spatially tunable, multi-scale porosity, which means creating structures that have different kinds of substances at different locations and with varied levels of porousness.

The object's porousness refers to it having tiny holes or gaps, and this is created by adjusting printing conditions and/or how much sacrificial material is used during the VIPS-3DP process. This can be useful for manufacturing things like porous medical implants or lightweight

aerospace products.

"This is a promising method for creating metallic products that require different levels of porousness," said Marc Sole-Gras, Ph.D., the first author of the paper and a former graduate student in Huang's lab. "A good example of this is in bone tissue engineering. We can print an implant that is appropriately porous to ensure it integrates with the surrounding human cells."

In addition to requiring less investments in infrastructure, the VIPS-3DP process is a greener option to traditional printing methods because it uses sustainable materials and less energy.

More information: Marc Sole-Gras et al, Vapor-induced phase-separation-enabled versatile direct ink writing, *Nature Communications* (2024). [DOI: 10.1038/s41467-024-47452-9](https://doi.org/10.1038/s41467-024-47452-9)

Provided by University of Florida

Citation: New 3D-printing method makes printing objects more affordable and eco-friendly (2024, April 10) retrieved 2 May 2024 from <https://techxplore.com/news/2024-04-3d-method-eco-friendly.html>

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