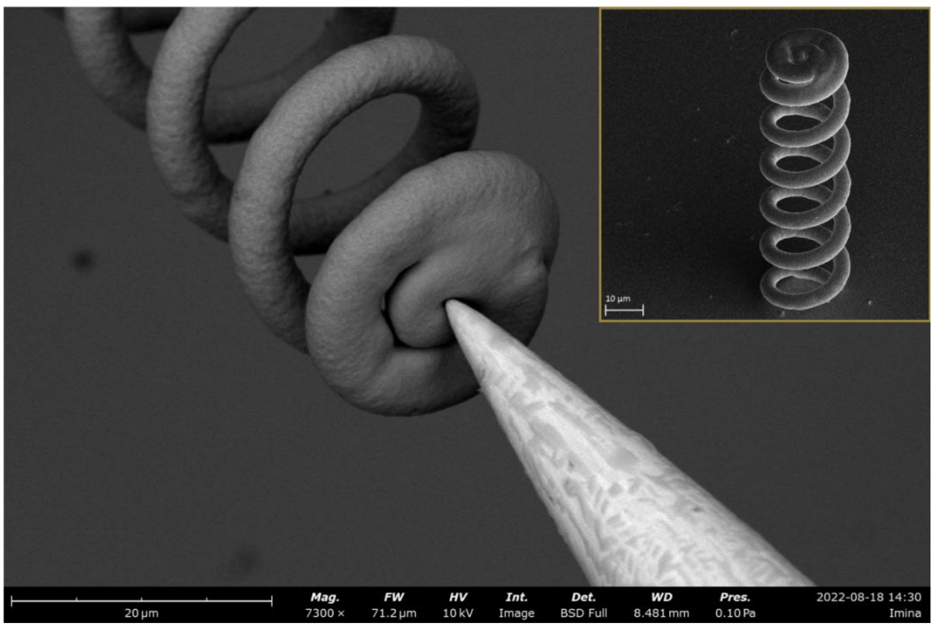
EXADDON

MANIPULATION AND PROBING OF 3D PRINTED METAL MICROSPRINGS IN A DESKTOP SEM

A collaboration between Exaddon, Imina Technologies, and ThermoFisher Scientific has resulted in fascinating images showing the precise manipulation of microscale metal springs, 3D printed by Exaddon and captured using desktop SEM.



MICROMANIPULATING µAM. Imina Technologies' miBot™ prober tip in contact with the top contact area of a microspring printed by Exaddon, inside the Thermo Scientific™ Phenom™ XL G2 Desktop SEM.

MEMS and many other microscale electronic systems or components require manipulation and electrical probing. Applications vary from academic research to industrial-scale quality control, but in either case users strive to get the best results possible in shortest time. Here, Exaddon, Imina Technologies, and ThermoFisher Scientific show how microprobing inside a Desktop SEM enables quick and precise characterization of microscale objects.

Exaddon is an expert in producing microscale springs with excellent material properties using its unique additive micromanufacturing (µAM) technology. Operating at room temperature, the CERES µAM system enables metal object printing with complex geometries directly on a chip surface via localized electrodeposition.

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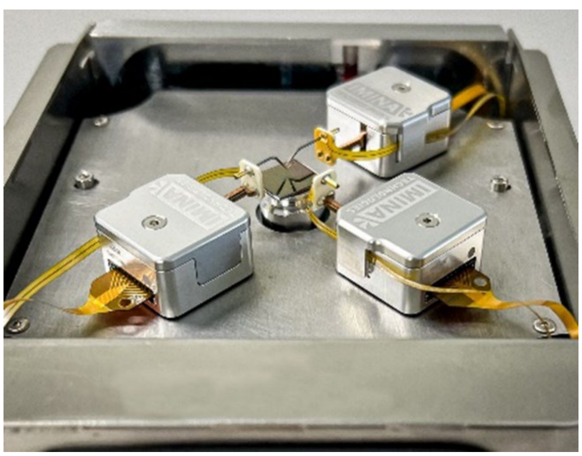
With this approach, each spring of an array can have different number of turns, vertical spacing, and pitch.

Here, the CERES µAM system was used to 3D print microscale copper springs on a copper substrate. The resulting spring is 90 µm high and 10 µm in radius, the diameter of printed metal being less than 4 µm. Such microsprings can be used as contacts in probing arrays.

The 3D-printed microspring was loaded into the Phenom XL G2 desktop SEM for characterization. An Imina Technologies in situ electrical probing system was integrated into Phenom XL G2. Here, the setup consisted of 3 miBot™ probers, freely moving over the base and electrically connected to the control unit outside of the microscope. Electrical probing and data collection and export were managed via Imina's Precisio™ software suite.



PRECISION INTEGRATION. miBot™ probers placed around Phenom XL G2 desktop SEM Sample holder.

The user-friendly motion control of miBot™ probers and the integrated optical navigation camera of Phenom XL G2 helped to quickly find and approach the sample location. The fast imaging capability and better than 10 nm resolution of Phenom XL G2 helped the probers to land on the 15 µm contact area of the spring and to observe its deformation in real-time.

To characterize the microspring, a tip of the miBot™ prober was placed on the spring's contact area, while the tip of another prober was in contact with the substrate. While the first tip gradually compressed the microspring, the I/V characteristics were recorded. With this setup, it was easy to measure the microspring conductivity and to determine the deformation necessary to have a good electrical contact with the spring.

This experiment brought together the expertise of Exaddon, Imina Technologies and ThermoFisher Scientific to produce, characterize and image copper microsprings. Exaddon 3D printed high-quality microsprings which were electrically characterized using Imina Technologies' *in situ* electrical probing solution. The experiment was conducted inside the Phenom XL G2 desktop SEM, which enabled quick and straightforward navigation around the sample and high-resolution imaging of the microsprings.

Spring Key Dimensions	
Height	90 µm
Radius	10 µm
Diameter of Printed Material	<4 µm
Number of turns	6
Vertical spacing between turns	15 µm
Voxels printed	1128
Voxel printing time	512s
Ink	Copper bright

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