IMINA TECHNOLOGIES

APPLICATION NOTE

Manipulation and Probing of 3D Printed Metal Microsprings in a 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 in the shortest time possible. Here, Exaddon, Imina Technologies, and ThermoFisher Scientific show how microprobing inside a desktop SEM enables quick and precise characterization of microscale objects.

Figure 1. miBot™ probers placed around Phenom XL G2 desktop SEM Sample holder.

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. 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.

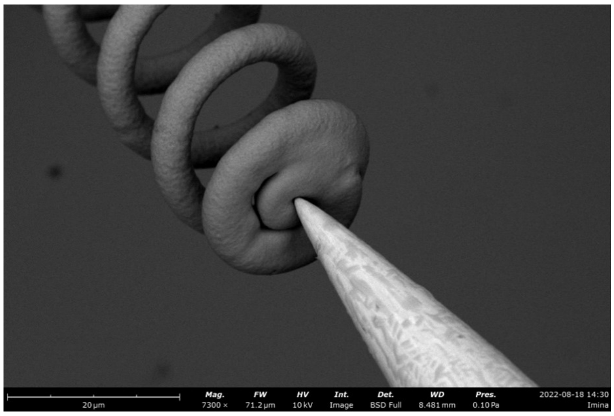

Figure 2. Imina Technologies' miBot™ prober tip in contact with the top contact area of a microspring printed by Exaddon, inside the Thermo Scientific™ Phenom™ XL G2 Desktop SEM

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 Precisio™ software suite.

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 with 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, characterise and image copper microsprings. Exaddon has 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.

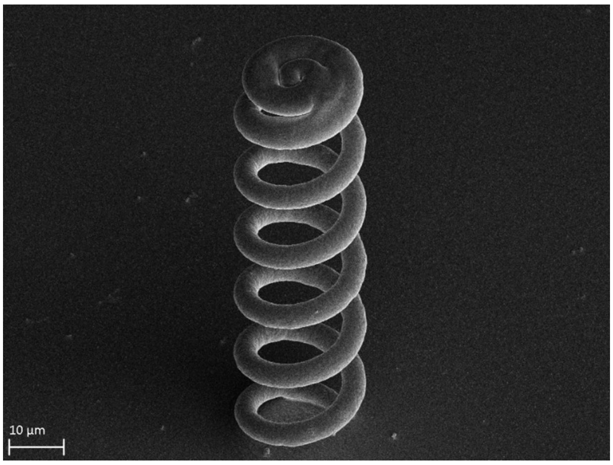

Figure 3. 3D spring printed using CERES µAM technology. Spring dimensions: height 90 µm, radius 10 µm, thickness <4 µm, 6 turns at 15 µm spacing. Printing parameters: 1128 voxels, printing time 512s.

In collaboration with:

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