Q&A for Webinar on Additively Manufactured Electronic Components in Multimaterial 3-D and 4-D Printing

Question 1: What is the probability for using 3D multimaterial printing to create a new power transformer for small appliances and high voltage transmission, changing the standard today of using mineral oil? Do you think it's feasible?

Manos Tentzeris: It is highly likely to be successful, it will depend on resolution required and thermal constraints, but lots of new appropriate 3D printable materials have come up over the last 2-3 years.

Yang Yang: Institute for Printed Circuits (IPC) is currently working on a new standard - IPC D-67 Additively Manufactured Electronics - to address the industry needs of using 3D multimaterial printing for creating electronic components. This new IPC standard will be important for electronic components designers to refer to.

Question 2: Is the high tanδ of your photocurable resins likely to have any impact on how your lenses or metasurfaces perform?

Manos Tentzeris: It depends on roughness, uniformity and thickness of the resin

Chi-Hou Chan: The loss tangent of the resin will certainly affect the gain of the lens antenna. This is why in our discrete dielectric lens designs, we stop at 300 GHz. The alternative implementation using effective dielectric constant with air voids would reduce the material loss. Therefore, the operating frequency can go up to 900 GHz.

Yang Yang: This is a good question. This Special Session of the Proceedings of the IEEE presents state-of-the-art 3D/4D printed lenses and metasurfaces designs, with the considerations of the loss tangent. The research findings reported in this Special Session will guide the designers based on their practical needs.

Question 3: I assume for flexible usage a proper developed liquid metal alloy is the way to go, for "wiring" ?

Manos Tentzeris: Now, you can 3D print ceramics or alumina/alumina ribbon materials that can handle significant amounts of power. Also, the 3D printing capability of complicated/optimized microfluidic channel topologies help further and embedding of 3W Power Amplifiers has been demonstrated.

Flexible implementation depends on the radius of flexing/curvature. You can print 6-10um of printed silver for radii about 3cm, and printable liquid metal channels or flexible hinges below that.

Yang Yang: 3D printing is a “Print on Demand” solution, which will significantly reduce the material wastes as an environmentally friendly manufacturing approach. For a long run, this represents the future of sustainable electronics.

Valentina Palazzi: Liquid metal has been used in combination with 3D printing for a variety of uses, such as to manufacture flexible/compressible antennas and as internal conductor of RF components in coaxial technology. Since channels can be dynamically filled and emptied, liquid metal has been used also for reconfigurable RF components, switches and sensors.

Question 4: Can you introduce the use of other noble gasses in the so called voids?

Chi-Hou Chan: The void is basically an air cavity.