



# Self-assembled Functionalized Microscale 3D Devices

**IP Status:** Issued US Patent; **Application #:** 15/482,386

## Microscale Structures

A new self-assembly approach produces functionalized three-dimensional (3D) micro cubic devices using lithographic methods. These methods fabricate functionalized microscale structures that are free-standing, hollow, 3D and large scale, and feature metal electric device patterning on the surface. Metal patterns (arrays of split ring resonators, or SRRs) acting as metamaterials are defined on the surface of the 3D dielectric micro containers, and the SRRs on all six facets of a given micro cube show a resonant behavior. Since desired metal and semiconductor patterns can be incorporated onto the surfaces, these 3D dielectric structures and their self-assembly process allow for the realization of next generation biomedical, electrical, optical and mechanical 3D microscale devices.

## Thin Film Delamination Reduced

This technology significantly improves upon existing self-assembling 3D microstructures, especially since multifunctional 3D micro devices have previously been too complex to fabricate. To avoid cracking or delamination due to spatial stress distribution on the materials during self-folding, a new sandwich-type structure reduces the stresses on the thin film. Furthermore, previous 3D structures were made in nanoscale and showed low yield (< 1%), while this new approach allows for the fabrication of freestanding polyhedral (cubic) micro structures with a yield of 90%.

## BENEFITS AND FEATURES:

- High yield production for 3D micro-devices
- Sandwich-type structure reduces delamination of thin film
- Functionalized, free-standing, hollow, 3D and large scale
- Desired metal and semiconductor patterns are defined on the surface

## APPLICATIONS:

- Next generation biomedical, electronic, and optical devices
- Chemical, gas and magnetic micro sensors
- Biochips
- Sensors and electric circuits
- Large scale, mass production, free standing, microscale, 3D structures

**Phase of Development** - Prototype devices demonstrate self-assembly and 3D structures

## Researchers

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**Publications**

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*Advanced Electronic Materials*, Volume 2, Issue 6 June 2016 1500459