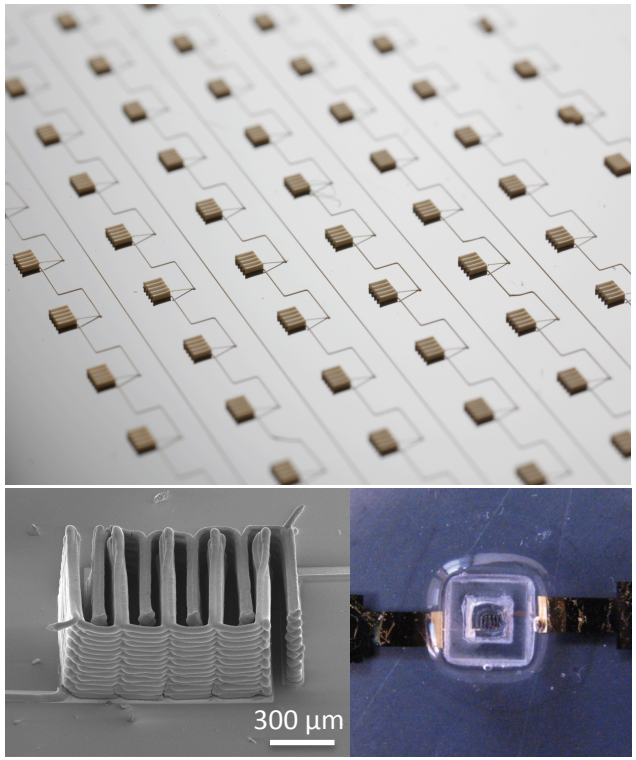
3D Printing of Li-Ion Microbattery Architectures



Optical image of as-printed battery array (top), SEM image (bottom left), and packaged battery (bottom right) of 3D interdigitated microbattery (3D-IMA).

Scientific Achievement

3D printing is used to fabricate 3D interdigitated microbattery architectures (3D-IMA) composed of high aspect ratio anode and cathode micro-arrays that are interdigitated on a sub-millimeter scale. These microbatteries exhibit amongst the highest areal energy and power densities reported to date.

Significance and Impact

Rechargeable Li-ion microbatteries are needed to power small autonomous devices, such as micro-electro-mechanical systems (MEMS), biomedical sensors, wireless sensors, and actuators. These 3D printed batteries are 1000x lighter than the smallest commercially available Li-ion batteries.

Research Details

- Concentrated anode ($Li_4Ti_5O_{12}$) and cathode ($LiFePO_4$) inks have been synthesized and printed through 30 µm nozzles
- High aspect ratio electrodes are patterned layer-by-layer, annealed, and then packaged to create fully working cells.

Work was performed at the University of Illinois at Urbana-Champaign and Harvard University.

K. Sun, T.-S. Wei, B.Y. Ahn, J.Y. Seo, S.J. Dillon, and J.A. Lewis, "3D Printing of Interdigitated Li-Ion Microbattery Architectures." *Advanced Materials* **25** (2013).