Reinforcement of Cu Nanoink Film with Extended Carbon Nanofibers for Large Deformation of Printed Electronics

Jeonghwan Kim¹, Akash Shankar¹, Jiahua Zhu², Daniel S. Choi³, Zhanhu Guo⁴, and Jong Eun Ryu†¹,⁵

¹Indiana University-Purdue University Indianapolis, Department of Mechanical Engineering; ²The University of Akron, Department of Chemical & Biomolecular Engineering; ³Masdar Institute of Science and Technology, UAE, Department of Mechanical & Materials Engineering; ⁴The University of Tennessee, Knoxville, Department of Chemical and Biomolecular Engineering; ⁵Indiana University-Purdue University Indianapolis, Integrated Nanosystems Development Institute

Metallic nanoparticle inks (nanoinks) have attracted great interest in the manufacturing of printed flexible electronics. However, micro-cracks and pores generated during the sintering process deteriorate mechanical and electrical characteristics of the sintered nanoink film. To alleviate these problems, we demonstrated the use of very long carbon nanofiber (CNF, average length 200 µm) to reinforce the sintered nanoink films. In this study, different weight fractions of CNFs are dispersed into the Cu nanoink to improve the mechanical bending characteristics. Scanning electron micrographs (SEM) shows improved dispersion of oxidized CNF in the nanoink compared to the as-received CNF. The composite nanoinks are stencil printed on polyethylene terephthalate (PET) film and sintered by intense pulsed light system using Xe-flash. The electrical measurements show 90 %, 65 %, and 66 % improved electrical conductivity in the composite nanoink film (0.7 % of oxidized CNF) compared to the pure Cu nanoink under the 75 mm, 50 mm, and 25 mm of bending radii, respectively.

Mentor: Jong Eun Ryu, Department of Mechanical Engineering, School of Engineering and Technology, IUPUI