Fabrication of Organic Transistor Based on Ink-Jet Printed Copper Electrodes

Sunho Jeong, Dongjo Kim, and Jooho Moon, Yonsei University, Seoul, Korea

Abstract

We have fabricated organic transistors based on ink-jet printed copper as source and drain electrodes. Ink-jet printing of metal nano-particles is an attractive alternative to photolithography for patterning conductive metal lines, due to the low-cost, low-waste and simple process. For conductive copper electrodes at low temperature heat-treatment below 250℃, nano-sized copper particles of 50nm diameter were printed on the highly doped silicon wafer with 300 nm-thick silicon dioxide layer that acts as a dielectric layer. It was observed that the conductivity of the ink-jet printed lines was similar to that of bulk copper material even though the heat-treatment was performed at such a low temperature. To achieve smooth conductive path with high resolution, the printing conditions of the distance between printed droplets, stage moving velocity, and temperature substrates were optimized. Pentacene was evaporated on the printed copper electrodes to fabricate the organic transistor, since pentacene offers higher mobility, better on-off ratio, improved environmental stability, and better reliability than most other organic semiconductors. The measured carrier mobility and on/off ratio of the fabricated bottom-contact organic transistor show similar performance when compared with the transistors based on evaporated gold electrodes.

Author Biography

Jooho Moon is an associate professor in School of Advanced Materials Science and Engineering at the Yonsei University, Korea. He holds a BA degree from Yonsei University, and MS and PhD degrees in materials science and engineering from the University of Florida. He did his postdoctoral research in the Materials Processing Center at MIT from 1996 to 1998, working on three-dimensional printing of ceramics. He was awarded a Japan Society of the Promotion of Science (JSPS) fellowship in 1998, conducting the research in the area of electrochemical NO reduction in the Synergy Ceramics Center at the National Industrial Research Institute of Nagoya, Japan. After 18 months fellowship, he joined the faculty as an assistant professor at the Yonsei University in 2000, and becomes an associate professor in 2003. His research interests have included ink-jet printing of self-assembling colloids and functional nanoparticles, printed electronics and displays, micro solid oxide fuel cell, micro patterning of ceramics, and organic-inorganic hybrid materials. Moon can be reached by e-mail at jmoon@yonsei.ac.kr.