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Printed Organic Field Effect Transistor with Solution Processed Nanocomposite Dielectric Gate Insulator

[Amjad S. Rasul](#)¹, Jie Zhang¹, Dan Gamota¹ and Christos G. Takoudis²,
(1)Physical Realization Research Center, Motorola Inc., 1301 E. Algonquin Rd.,
RM 1014, Schaumburg, IL 60196, (2)Dept of Chemical Engineering, University of
Illinois at Chicago, 810 S Clinton St, Chicago, IL 60607

Printed organic field-effect transistor (OFET) with solution processed, high K nanocomposite dielectric gate insulator was demonstrated. A nanocomposite consisting of cross-linked Propylene Glycol Methyl Ether Acetate (PGMEA) and Barium Titanate (BTO) nanoparticles was developed and utilized as the gate insulator. The high relative permittivity ($k=35$), bimodal nanocomposite utilized had two different filler particle sizes 200 nm and 1000 nm diameter particles. Bottom contact organic field-effect transistors were demonstrated using a combination of low cost printing and spray coating technologies. A metal coated plastic film was used as the flexible gate substrate with an amorphous organic semiconductor material as the active layer. OFETs with the solution processed nanocomposite dielectric had a high field-induced current and a low threshold voltage and thus a low operating voltage due to the high capacitance gate insulator. We review the characteristics and interfacial aspects of the nanocomposite material and discuss the processing and performance of the printed organic devices