Organic thin-film transistor memory with nanocrystal carbon dots

Abstract

Organic thin-film transistor (OTFT) memory devices were fabricated with nanocrystal carbon (nc-C) dots incorporated into the pentacene/oxide interface in the active layer. The nc-C dots were arranged precisely in order on the OTFT channel region by a focused ion beam (FIB) technique using low-energy Ga + ions and phenanthrene as the carbon source. The structural information of nc-C dot arrays was obtained by scanning ion microscopy (SIM) and atomic force microscopy (AFM). These images indicate that the nc-C dot array was successfully formed on the oxide layer. The density of the two-dimensional nc-C dots was 1.3-1.5×108 cm-2. The current-voltage (I-V) characteristics showed that the OTFTs exhibit memory behavior upon the application of forward and reverse gate bias stresses. Depending on the polarity of gate bias, write and erase modes were induced, and a maximum threshold voltage shift ΔVth of 0.97 V was obtained.