Development of Fluorinated Hybrid Dielectric Material for Printed Organic Thin Film Transistors

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The Printed electronics have been attracted for the low-cost, large area applications such as thin film transistors and electronic devices. In order for such low-cost solution processed electronic devices to become a reality, all parts of thin film transistors must be solution-processable to be compatible with the low cost fabrication techniques. Most examples of printing materials for the organic transistors are conjugated electrodes and semiconductors, but solution-processable gate dielectric materials are relatively limited so far due to several issues such as chemical resistance and compatibility. Chemical compatibility of dielectric materials should be especially considered for the fabrication of top-gate organic transistors or multi-layered devices. Additionally, high dielectric constant insulating material plays a key role to reduce the driving voltage of thin film transistors. These technical issues lead to develop new solution based insulating materials which have both relatively high dielectric constant and immiscibility with ordinary organic layers.

To solve these technical problems, high dielectric constant inorganic nanoparticles such as barium titanate were synthesized and applied fluorinated ligands to nanoparticles by ligand exchange. These hybrid materials can be dispersed in fluorinated solvent and showed suitable coating properties for the formation of gate insulator thin films. In order to evaluate the electrical properties of fluorinated hybrid dielectric material, metal-insulator-metal diode and top-gate organic thin film transistor were fabricated and characterized.

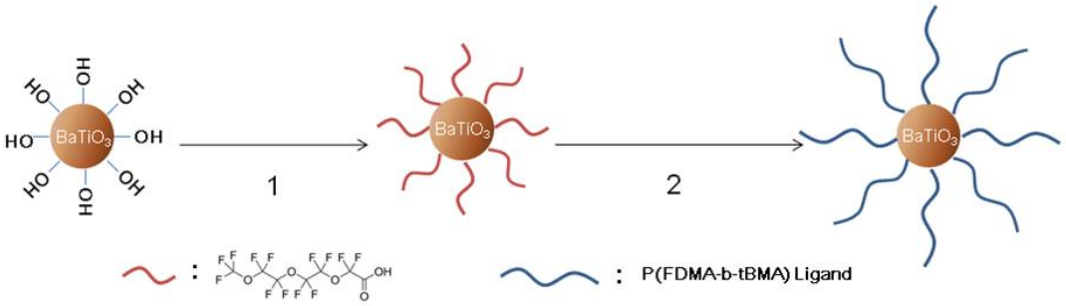

Fig. 1. Ligand exchange scheme of fluorinated inorganic nanoparticles

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