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Effects of Simultaneous Bending and Heating on Characteristics of Flexible Organic Thin Film Transistors

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Recently, active materials such as amorphous silicon (a-Si), poly crystalline silicon (poly-Si), transition metal oxide semiconductors (TMO), and organic semiconductors have been demonstrated for flexible electronics. In order to apply flexible devices on the polymer substrates, all layers should require the characteristic of flexibility as well as the low temperature process. Especially, pentacene thin film transistors (TFTs) have been investigated for probable use in low-cost, large-area, flexible electronic applications such as radio frequency identification (RFID) tags, smart cards, display backplane driver circuits, and sensors. Since pentacene TFTs were studied, their electrical characteristics with varying single variable such as strain, humidity, and temperature have been reported by various groups, which must preferentially be performed in the flexible electronics. For example, the channel mobility of pentacene organic TFTs mainly led to change in device performance under mechanical deformation. While some electrical characteristics like carrier mobility and concentration of organic TFTs were significantly changed at the different temperature. However, there is no study concerning multivariable. Devices actually worked in many different kinds of the environment such as thermal, light, mechanical bending, humidity and various gases. For commercialization, not fewer than two variables of mechanism analysis have to be investigated. Analyzing the phenomenon of shifted characteristics under the change of multivariable may be able to be the importance with developing improved dielectric and encapsulation layer materials. In this study, we have fabricated flexible pentacene TFTs on polymer substrates and observed electrical characteristics of pentacene TFTs exposed to tensile and compressive strains at the different values of temperature like room temperature (RT), 40, 50, 60^{o}C. Effects of bending and heating on the device performance of pentacene TFT will be discussed in detail.

Keywords: Pentacene, Bending, Heating, Flexible device