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Current Increase Effect and Prevention for Electron Trapping at Positive Bias Stress System by Dropping the Nematic Liquid Crystal on the Channel Layer of the a-InGaZnO TFT's

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The effect of nematic liquid crystal(5CB-4-Cyano-4'-pentylbiphenyl) on the amorphous indium gallium zinc oxide thin film transistors(a-IGZO TFTs) was investigated. Through dropping the 5CB on the a-IGZO TFT's channel layer which is deposited by RF-magnetron sputtering, properties of a-IGZO TFTs was dramatically improved. When drain bias was induced, 5CB molecules were oriented by Freedericksz transition generating positive charges to one side of dipoles. From increment of the capacitance by orientation of liquid crystals, the drain current was increased, and we analyzed these phenomena mathematically by using MOSFET model. Transfer characteristic showed improvement such as decreasing of subthreshold slope(SS) value 0.4 to 0.2 and 0.45 to 0.25 at linear region and saturation region, respectively. Furthermore, in positive bias system(PBS), prevention effect for electron trapping by 5CB liquid crystal dipoles was observed, which showing decrease of threshold voltage shift $[(\Delta V)_{TH}]$ when induced +20V for 1~1000sec at the gate electrode.

Keywords: TFT, IGZO, Liquid crystal