Title: Effect of Proton Irradiation on the Electrical Performance on SnO_2 Thin Film Transistor with ITO Electrodes

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As the aerospace industry continues to grow, there is increasing interest in the performance of electronics operating under extreme environments such as space. Among various electronics, oxide-based thin film transistors (TFTs) have emerged as essential components in various information technology applications. For aerospace use of the oxide TFTs, first and foremost, it is crucial to understand how space radiation affects the performance of TFTs. The channels of oxide TFTs are typically made from materials such as IGZO, IZO, ZnO, SnO2, etc. Numerous studies have evaluated the effects of radiation on IGZO, IZO, and ZnO-based TFTs. **[1-4]** However, the impact of high-energy radiation on SnO2-based TFTs remains largely unexplored.

Among various types of radiation, protons are used to comprehensively analyze the effects of space radiation because they not only constitute a significant component of the space radiation environment but also allow for precise assessment of radiation-induced damage by measuring changes in parameters such as carrier density, transconductance, and other electrical properties. **[5, 6]**

In this study, SnO_2 films with thicknesses of 6.5 and 20 nm thick were prepared using thermal atomic layer deposition. The 20-nm films were used for various material characterizations, while the 6.5-nm films were used for TFT fabrication. **[7, 8]** Both the films and devices were irradiated with a 5-MeV proton beam at fluences of 10^{11}, 10^{12}, 10^{13}, and 10^{14} cm^{-2}. Changes in the physical properties of the SnO_2 films were examined by Hall measurements and x-ray photoemission spectroscopy. For the TFTs, we used ITO (thickness = 100 nm) as the source and drain electrodes. Device performance was evaluated using a semiconductor parameter analyzer. In this presentation, we discuss a systematic investigation into the impact of proton irradiation on device performance, with particular attention to variations in the material properties.

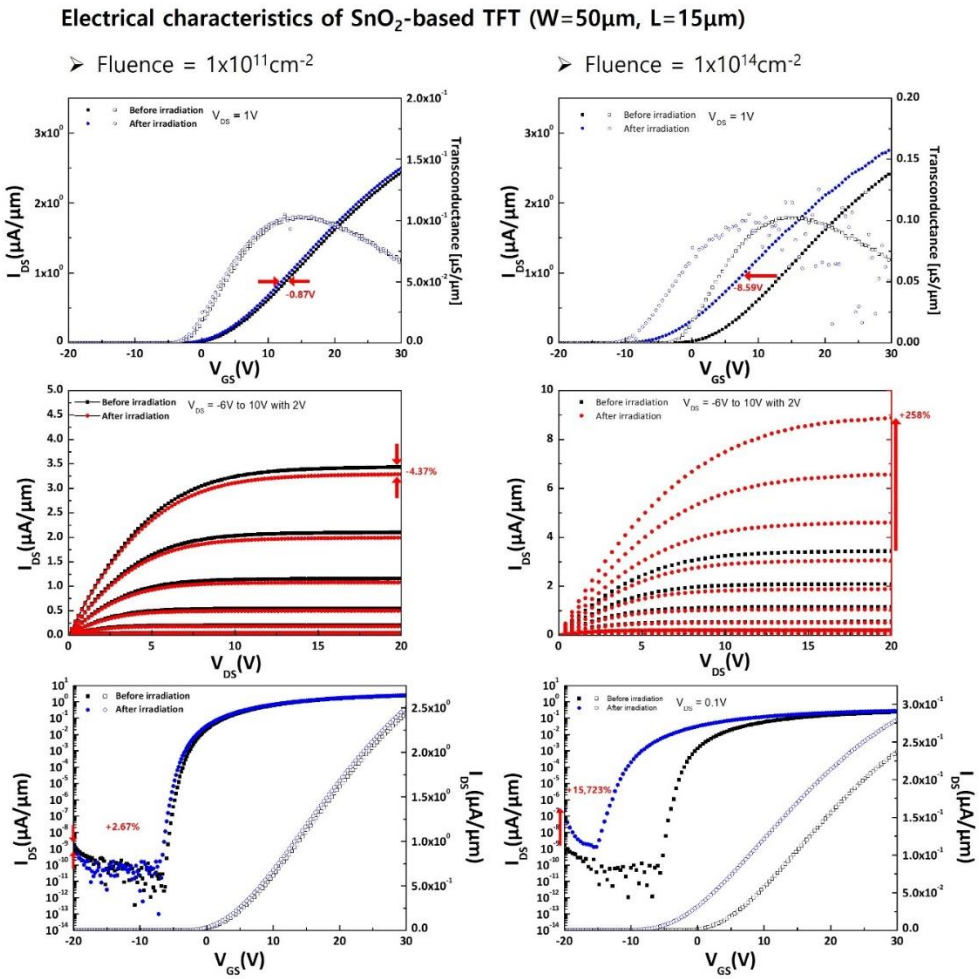

Figure 1. Electrical characteristics of SnO_2-based TFT (W=50μm, L=μm)

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