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Characterization of indium tin oxynitride thin films for application as ReRAM contacts

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ITON thin films were first reported in 2003 by Aperathitis et al., where the authors demonstrated that the optical absorption edges of the RF-sputtered ITON films occurred at shorter wavelengths when compared to ITO. By increasing the amount of nitrogen in the plasma during deposition, the films showed an increase in overall transmittance, compensated by a reduction in the carrier concentration and mobility, increasing electrical resistivity. In summary, the authors found ITON to have better optical properties, while ITO showed better electrical properties. The characteristics of ITON depend on the nitrogen concentration that is in-corporated in its structure. Resistivity tends to increase as more nitrogen is incorpo-rated in ITON by occupying oxygen vacancies. Regarding applications, due to its improved ultraviolet (UV) transmission in comparison to ITO, ITON has been used as Schottky contacts for GaN based UV photodetectors. Is has also been applied on blue light emitting diodes fabrication. Even though the observed material potential, there are few published papers on this subject to date. In this work, Indium Tin Oxynitride films were fabricated by evaporation and annealing techniques and electrical parameters were characterized. Incorporation of nitrogen into the film by annealing with differents temperatures (300 °C, 350 °C, 400 °C, 450 °C, 500°C, 550°C and 600 °C) could improve further the optical and electrical properties of the ITON films and thus making ITON film an ideal transparent and conducting material for opto-electronic applications. Substrates were silicon (75 mm, p-type, 1-10 ohm.cm) and optical three-inch glass wafers with 0.5 mm thickness. The thin films were analyzed with UV-Vis, Raman and Hall effect analyses. The main objective of this study is memory resistive contacts fabrication. The incorporation of nitrogen during the annealing process results in the decrease of the band gap to a region of visible light lengths improving the absorption and generation of carriers.