

**Effects of Annealing Conditions on Optical and Electrical Characteristics of Titanium Dioxide Films Deposited by Electron Beam Gun Evaporation**

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**ABSTRACT**

We report measured evolutions of the optical band gap, refractive index and relative dielectric constant of TiO<sub>2</sub> film obtained by electron beam gun evaporation and annealed in an oxygen environment. A negative shift of the flat band voltage with increasing annealing temperatures, for any film thickness, is observed. A dramatic reduction of the leakage current by about four orders of magnitude to  $5 \times 10^{-6}$  A/cm<sup>2</sup> (at 1 MV/cm) after 700°C and 60 min annealing is found for films thinner than 15 nm. An equivalent SiO<sub>2</sub> thickness on the order of 3–3.5 nm is demonstrated. A new approach is presented to establish that at different ranges of applied voltage the hopping, space charge limited current and Fowler-Nordheim are the basic mechanisms of carrier transport into the TiO<sub>2</sub> film.