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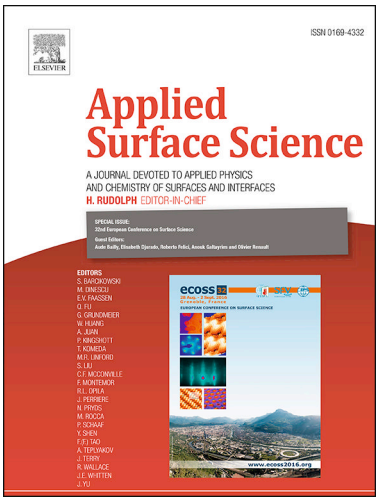

Full Length Article

Plasma Electrolytic Oxidation of Mono-Crystalline Silicon Using Silicate Electrolyte Containing Boric Acid

Aidin Bordbar Khiabani, Sema Ebrahimi, Benyamin Yarmand

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Plasma Electrolytic Oxidation of Mono-Crystalline Silicon Using Silicate Electrolyte Containing Boric Acid

Aidin Bordbar Khiabani, Sema Ebrahimi, Benyamin Yarmand*

Nanotechnology and Advanced Materials Department, Materials and Energy Research Center (MERC), Karaj, Iran

Corresponding author's email: *byarmand@merc.ac.ir

Abstract

The feasibility of preparing oxide layer on a monocrystalline silicon (mc-Si) using the plasma electrolytic oxidation (PEO) process was investigated in this study and the influence of adding boric acid to the silicate-based electrolyte on the formation and the properties of the oxide layer was evaluated. The morphology, chemical composition and phase structure of the layers were characterized by scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS), Fourier transform infrared spectroscopy (FTIR), grazing incidence X-ray diffractometry (GIXRD) and transmission electron microscopy (TEM) techniques. The optical and electrical properties of the grown layers were assessed by ultraviolet-visible spectroscopy (UV-Vis), photoluminescence spectroscopy (PL) and current-voltage measurement methods. The results revealed that an amorphous silicon oxide (SiO_2) layer with a crater-like morphology was formed on the mc-Si substrate in the silicate-based electrolyte. The addition of boric acid to the electrolyte led to dramatic arcing, stable layer formation conditions, and improved feature quality. The presence of BO_3^{3-} anions in the electrolyte accelerated the rate of growth, increased the layer surface porosity, and doped the SiO_2 structure with boron cations. As a result of these changes, the optical absorbance and photoluminescence emission intensity of the doped oxide

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