

Humidity Sensitivity and Sputtering Conditions of ZnO Films

Manabu Sato and Tatsuo Yamamoto

Faculty of Science and Engineering, Ishinomaki Senshu University,
Ishinomaki 986, Japan

(Received November 13, 1991; accepted January 29, 1992)

Key words: ZnO film, sputtering, humidity, orientation, SAW

Relationships among the reactive sputtering conditions, the sensitivity of ZnO polycrystalline films to humidity and the orientation of ZnO films have been studied. The sensitivity and orientation of ZnO films are evaluated by means of the variation of phase velocity of SAW and the X-ray diffractometer, respectively. It is found that lower oxygen gas pressure or/and lower substrate temperature enhance the sensitivity of the films to humidity, but the sensitivity does not correlate with the orientation. ZnO films relatively sensitive to humidity show degradation of piezoelectricity in the high relative humidity range.

1. Introduction

The application of surface acoustic wave (SAW) devices has recently been extended from performing conventional signal processing to various sensor capabilities.⁽¹⁾ The planar nature of SAW devices, in which the acoustic signal is confined to the surface region, makes the device extremely sensitive to surface perturbations. This characteristic has been exploited in the construction of SAW chemical sensors.⁽²⁾ Most SAW chemical sensors rely on variations of the phase velocity of SAW with the adsorption of gas on chemical interfaces. These chemical interfaces are films on which SAWs propagate and which adsorb vapor molecules. Chemically selective coatings are usually employed for these chemical interfaces.

In contrast, ZnO films are generally employed as piezoelectric films in SAW devices, and a device which uses the ZnO film as a chemical interface and a piezoelec-