Measurement of Square Resistance In Situ of SnO_2: F Thin Film With Annealing at High Temperature Under Air

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Thin films of fluorine doped tin oxide (SnO2: F), deposited by spray pyrolysis on silicon substrate, were characterized by the method of four points probe in situ during annealing at high temperature under air. The evolution of square resistance (in situ) with the annealing temperature was interpreted in terms of competition between electronic conduction and ionic conduction. A square resistance of 136Ω/□ is measured before annealing and after annealing at 900°C, the square resistance increases appreciably to reach 40kΩ/□. This increase is explained by the absorption of oxygen at the films surface and an increase in SiO_2 thickness at interface SnO2/Si.

1. Introduction

Transparent conducting oxide (TCO) films consist of degenerate wide band gap semiconductors with low resistance and high transparency in the visible region. Tin oxide (SnO_2) has emerged as one of the most used transparent conducting oxide films. Conductivity of SnO_2 is controlled by intrinsic defects, e.g., oxygen vacancies and/or tin interstitials, which act as n-type donors [1]. The electrical resistivity is lowered further by extrinsic doping with fluorine or antimony. Fluorine doped tin oxide (SnO_2:F) is a promising material for solar cell application such as antireflection coating and transparent electrode.

There are many deposition techniques by which the thin TCO films SnO_2:F can be prepared such as sputtering [2] reactive evaporation [3], metal-organic chemical vapour deposition (MOCVD) [4], laser deposition [5] and spray pyrolysis [6,7].

In this paper, we propose to measure the square resistance in situ, of SnO_2:F thin films, with annealing at high temperature under air .

2. Experimental

Thin films of fluorine doped tin oxide (SnO_2: F), were prepared by conventional spray pyrolysis on mono-crystalline silicon substrate (FZ) of resistivity 0.1Ω/cm.

In order to study the evolution of square resistance in situ with annealing at high temperature and under air, the system schematised in Fig.1 is realised.

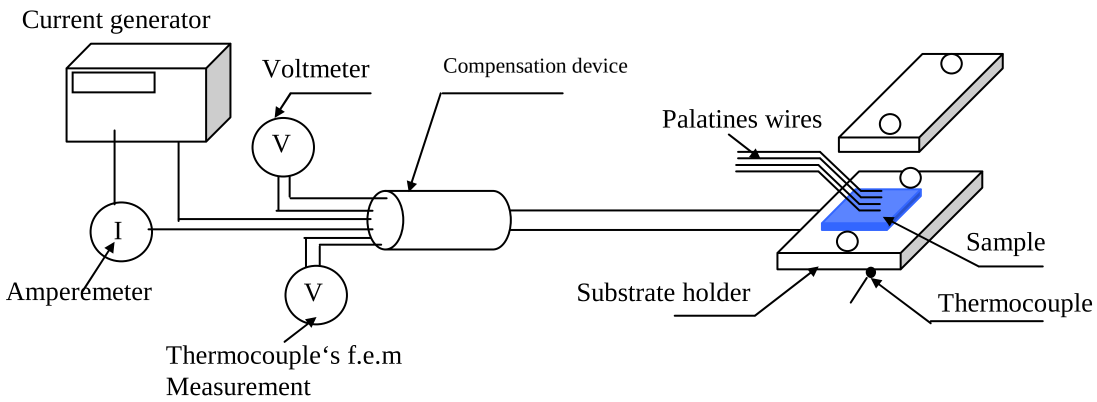

Fig.1: Square resistance measurement system.

3. Results and discussion

The evolution of square resistance in situ according to the temperature of annealing is presented in the Fig. 2.

References

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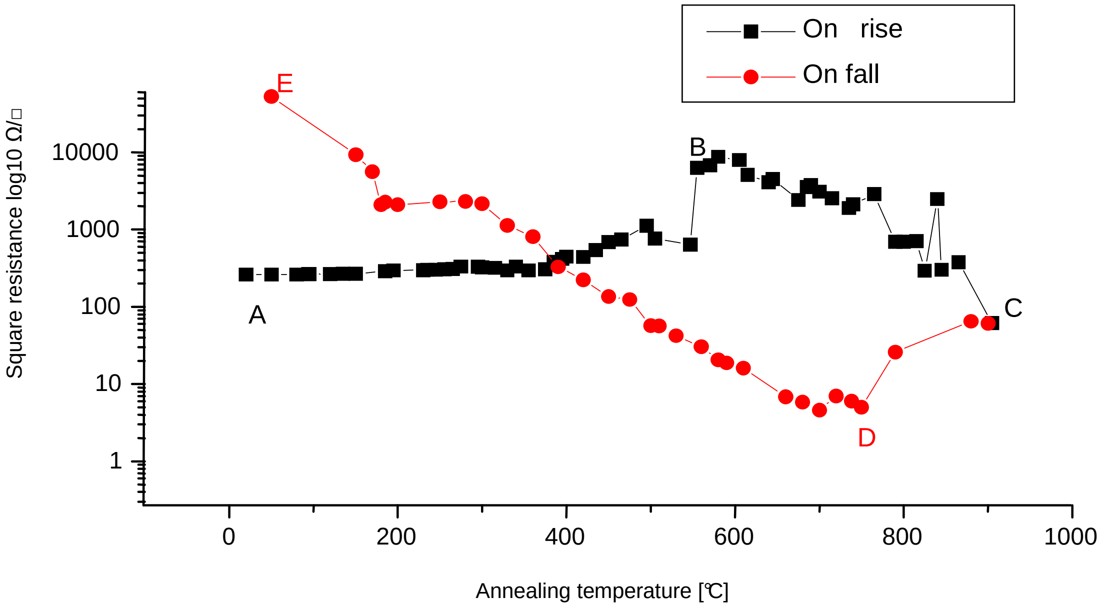

Fig.2: In situ square resistance evolution according to the annealing temperature.