

LAYERS OF INORGANIC OXIDES PREPARED BY SOL-GEL METHOD AND ITS ELECTRICAL PROPERTIES ON HIGH HUMIDITY

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Metodou sol-gel byly připraveny tenké vrstvy oxidu titaničitého nebo oxidu křemičitého na interdigitálních zlatých elektrodách a tepelně zpracovány na různé teploty. Elektrické vlastnosti připravených vrstev při laboratorní teplotě byly sledovány v závislosti na definované vlhkosti a měřicí frekvenci. Důraz byl věnován chování při vysokých vlhkostech pro potenciální použití jako vlhkostních senzorů.

Key words: *sol-gel method, titanium oxide, silica, electrical properties, humidity sensor*

Introduction

Electrical characteristic of TiO_2 and SiO_2 layers are sensitive to humidity, that's why they could be potential used as functional layers of humidity sensor. Preparation of these layers by using sol-gel method is quite easy and cheap, and with thermal process can notably influence on final characteristic of the layers (like porosity, activity of surface Ti-OH or Si-OH groups thereby their electrical characteristic). Mentioned layers however have quiet high electrical resistance and small sensitivity for low humidity values, on the other side they are chemically resistant and can endure even environment saturated with water vapours or increased temperature. That is why could be interesting their using in cheap humidity sensors intended for high and medium humidity.

Experimental part

Gold interdigital electrodes on corundum ceramics with 25 μm distance between each electrodes from Tesla Blatná was used as substrate. TiO_2 and SiO_2 layers were prepared by sol-gel method from titanium isopropoxide or tetraethyl-orthosilicate controlled hydrolysis and polycondensation in isopropyl alcohol at acid catalysis. After preparation layers by spin coating method was thermal elaboration of samples done while temperatures 180, 350 or 500 $^\circ\text{C}$ for the duration of 1 hour.

For measuring of the characteristic of prepared samples were used LCR meter HIOKI 3532-50 and impedance connecting cables were compensated. At voltage 1 V was measured the electrical characteristic of samples (impedance, capacitance, conductivity and phase φ) in frequency range from 500 Hz to 3 MHz. Atmosphere with defined humidity was ensure saturated salt solution [1]. On the fig. 1 is example of comparison of impedance of SiO_2 layer and pure substrate Bi2 (without layer) in dependence on humidity.

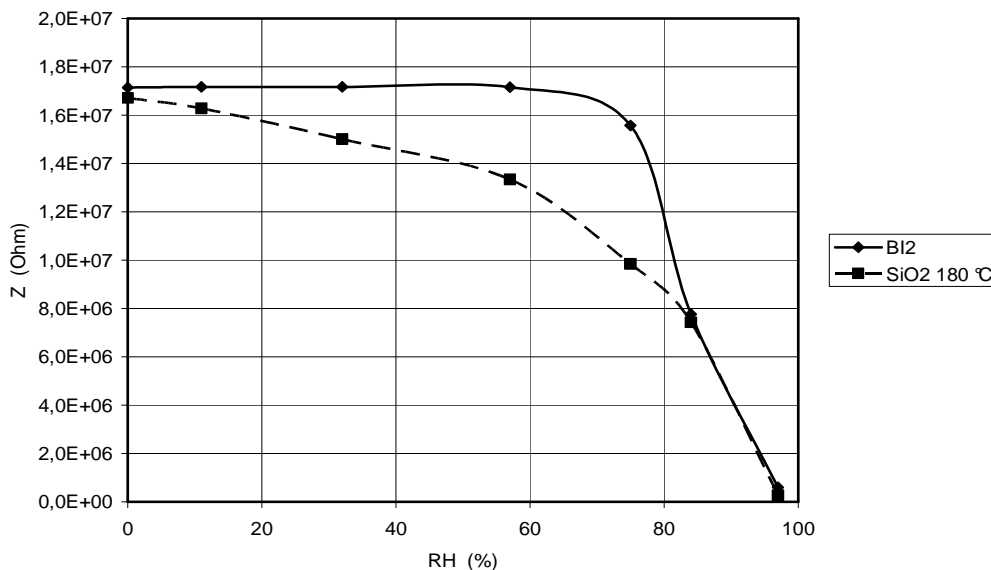


Fig. 1 Dependence impedance of pure substrate (BI2) and substrate with SiO₂ layer (180 °C) on relative humidity (frequency 500 Hz).

Conclusion

For prepared layers appears like most promising silica thermally processed at 180 °C. Maximal sensitivity to change of humidity at medium and high humidity was expressed at observing impedance at low frequencies 500 till 3000 Hz.

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References

- [1] Standard Practice for Maintaining Constant Relative Humidity by Means of Aqueous Solutions. ASTM E 104-02, 2002.