

# Book of Abstracts



Escola de Engenharia da Universidade do Minho

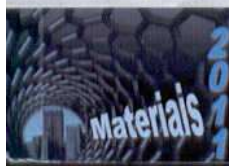
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## AlN<sub>x</sub>O<sub>y</sub> THIN FILMS FOR ELECTRICAL APPLICATIONS

R.E. Sousa<sup>1,2</sup>, J. Borges<sup>1,2</sup>, R. Arvinte<sup>1,2</sup>, F. Vaz<sup>1,2</sup>, L. Marques<sup>1,2</sup>

<sup>1</sup>Centre of Physics, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal, [rjemgs@gmail.com](mailto:rjemgs@gmail.com)

<sup>2</sup>Department of Physics, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal

Aluminium oxide (Al<sub>2</sub>O<sub>3</sub>) is an insulator material, with high electrical breakdown, large band gap and high permittivity. Its dielectric properties make it a promising candidate to be used as gate material instead of SiO<sub>2</sub> in microelectronic applications, such as in flash memory circuits, organic thin film transistors (OTFT) and MOSFETs. On the other hand, aluminium nitride (AlN) is a ceramic piezoelectric material with high electrical resistivity and excellent thermal properties, that has been used in many applications such as substrate in microelectronic devices, fabrication of high power and high temperature electronic devices, surface acoustic wave (SAW) devices, and electronic packaging.

The interesting electrical properties of Al<sub>2</sub>O<sub>3</sub> and AlN opens the door to study the electrical properties of the Al-N-O system, which, in a first approach, can combine some of both Al<sub>2</sub>O<sub>3</sub> and AlN advantages by tailoring the concentrations of the three elements, according to the particular application envisaged. The use of aluminium oxynitride is not yet very common, despite some very few examples in the field of protective coatings, optoelectronics, and in microelectronics as a dielectric in multilayer capacitors.

The main objective of the present work is to study the variation of the electrical response of the AlN<sub>x</sub>O<sub>y</sub> thin films as a function of the composition of the prepared films, using as reference the two base binary systems: AlN<sub>x</sub> and AlO<sub>y</sub>. The films are deposited by DC magnetron sputtering, with the discharge parameters monitored during the deposition in order to control the chemical composition, according to the particular results of the electrical behaviour. The electrical resistivity of the films is observed to depend strongly on film stoichiometry, composition and structure of the samples. Preliminary results show a smooth transition of the film's electrical characteristics between those of closely metallic (similar to the response of pure Al films), towards those of AlN and Al<sub>2</sub>O<sub>3</sub> films. These results confirm the possibility to tailor in a very smooth way the characteristics of materials between those of metallic towards insulating ones, opening thus a widespread of possible applications.

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**Keywords:** Aluminium oxynitride; Aluminium oxide; Aluminium nitride; Electrical resistivity.