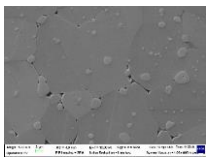
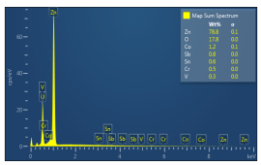
PARTNER PRESENTATION AND INTEREST IN HORIZON EUROPE PARTICIPATION

Development of disc-shaped metal oxide varistors (MOVs) containing ZnO and/or TiO_2 semiconductors and various MO dopants for low, medium or high voltage applications

Short description of topic (scientific description)

Background: MOVs based on ZnO, SnO_2, or TiO_2 semiconductors are voltage-dependent resistors composed of a dense and conductive matrix of ZnO/SnO_2/TiO_2 grains (majoritary phase) with adjacent resistive grain boundaries (GBs) of a mixture of various MO additives. Bi_2O_3, V_2O_5 and Pr_6O_{11} are varistor forming oxides (VFOs), while MOs like MnO_2, Mn_3O_4, Nb_2O_5, Co_2O_3, Er_2O_3, Y_2O_3, Sm_2O_3, Dy_2O_3, La_2O_3, CeO_2, etc. are used as varistor enhancing dopants (VEDs). The type, content and grain size of the semiconductor matrix and MO dopants, along with the preparation techniques and synthesis conditions of the MOV powders, consolidation techniques, processing parameters, size and shape of MOVs greatly influence the microstructure, technical characteristics and functional behaviour of MOVs during operation in voltage surge protection devices (SPDs) utilized in industrial and consumer electronics and electric power systems to protect them against temporary overvoltages and current surges.

Expertise of ICPE-CA, DMMCP


- ✓ Development of MOV discs based on (i) ZnO doped with V_2O_5, Sb_2O_3, Co_3O_4, SnO_2, and Cr_2O_3 (at TRL 7), and (ii) SnO_2 doped with Bi_2O_3, CuO, NiO, MnO_2, ZrO_2 or Co_3O_4 (at TRL 5) for MV surge arresters.
- ✓ Electrical tests were performed by Maira Montaj SRL within the national R&D Contract no. 327 PED/2020 between INCDIE ICPE-CA (Coordinator) and Maira Montaj SRL (SME partner).

Project proposal / Future works

- ➢ Development of novel formulations of MOV powders and manufacturing by powder metallurgy of disc−shaped MOVs based on ZnO and/or TiO_2 semiconductors and various amounts of micro and/or nanocrystalline MO dopants, including rare element oxides (REOs) for low, medium or high voltage applications.
- ➢ Investigation of MOV powders and discs by XRD, UV-Vis spectroscopy, SEM, EDX, and dielectric behaviour of MOV discs.
- ➢ Envisaged TRL at the project end: TRL 7

Short description of Organization/Laboratory/Department:

The Department of Metallic, Composite, and Polymeric Materials (DMMCP) is composed of **Laboratory of Metallic Materials (LMMet)** and **Laboratory of Radiochemistry and Polymeric Materials (LRMP)**.

The main directions of research, development, and innovation of the LMMet are the followings: ► Industrial research and experimental development of innovative and/or improved metallic and composite advanced materials for applications in priority areas; ► Applied research in the field of advanced materials and components for energy, electrical engineering, special and/or environmental applications; ► Development of interdisciplinary researches in the field of metal surface functionalization and the study of the properties at the interface; ► Eco-nano/micro technologies and emerging technologies for achieving new advanced materials. **The research infrastructure, research services and technological services of the DMMCP** are presented on https://eeris.eu/ERIF-2100-000T-7855

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Reference of Call/ topic of interest: advanced materials
Potential contribution/ main ideas:
INCDIE ICPE-CA: development of novel formulations of MOV powders and MOV discs, and investigation of MOVs in terms of structural, optical, mechanical, and dielectric properties
Potential RTD/UNI/SME/IND partners: microstructure modelling by FEM, electrical tests of MOVs (discharge voltage, breakdown voltage (V_B) or breakdown field (E_B) at 1 mA/cm^2, leakage current at 80% of V_B or E_B, high/low-current, short/long-duration discharge, thermal stability test, aging test).

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