Production and characterization of morphological and microstructural composite bulk or film for the study of interactions multiphysics

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Production and morphological and microstructural characterization of composite bulk or film for the study of multiphysics interactions

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Research activity


Field: Materials and Ceramic Devices for Electromechanical Applications

Supervisor: Dr.ssa Carmen Galassi

Activities:

1. MICROSTRUCTURAL CHARACTERIZATION
   - FEI Quanta 200 ESEM scanning electron microscopy
   - Energy dispersive spectroscopy (EDS)
   - Quantitative image analysis
   - X-ray diffraction
   - Scanning electron microscopy
   - TEM analysis

2. CERAMIC PROCESSES
   - Starting materials
   - Ball milling
   - Drying
   - Sieving
   - Pole polishing
   - Sintering
   - Cutting

3. SCIENTIFIC TRAINING AND DISSEMINATION
   - CCMX Advanced Course: "Powder Characterization and dispersion: from nanometers to micrometers and from theory to practice".
   - Conference for Young Scientists in Ceramics. Oral presentation: "Thick dielectric films produced by electrophoretic deposition".
   - Seminar: "Trattamenti superficiali e rivestimenti in una moto da competizione".
   - Workshop SIMUFER MP904. Poster presented: "Structure analysis of cobalt ferrititanite-silica composite".
   - Student contest presentation: 9th International Conference on Electrochemical Deposition. Oral and poster presented: "Thick composite magneto-dielectric films produced by electrophoretic deposition".

Materials and devices

- We studied magneto-dielectric composite materials based on TiO₂-CoFe₂O₄ system. These materials were used as substrate for Miniaturized Microstrip Antennas.

- Others magnetic ceramics synthesized: BaFe₃O₅, Sr₂Fe₂O₅, Ba₃Co₂Fe₂O₉, Ba₅Co₅Fe₂O₁₄, Sr₃Co₂O₅,.

- Magneto-electric thick film was produced.

- We are investigating the extrinsic effect of grain size on the functional properties of Pb(Zr,Ti)O₃ where x = 1, 0.98, 0.97, 0.96, 0.954, 0.95, 0.946, 0.938, 0.93, 0.925, 0.92, 0.88, 0.86 and 0.80.

This work is also involving on TiO₂ bulk ceramic materials.

Work's outline

All the carried out work aims to the development of multifunctional ceramic composites with:

- HIGH DENSITY
- MICROSTRUCTURAL HOMOGENEITY
- RELIABILITY
- COUPLED FUNCTIONAL PROPERTIES

The goal is the application of these materials into commercial devices. In order to achieve these objectives we are working on both single phases and mixtures while controlling and investigating processability and final functional properties of the materials.