Department of Materials Science - CENIMAT / I3N

Cork: electroactive material?

Dielectric Materials and Structures Group
at DCM/FCT/UNL and Cenimat / I3N

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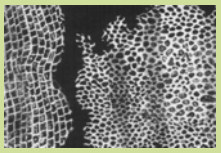
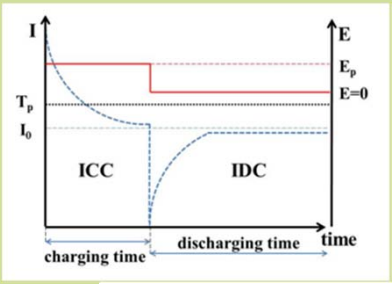
• Physics degree, FC/UL, 1988.
• PhD in Physics Engineering, FCT/UNL, 2003.
• Current Research Interests: Dielectrics - ecomaterials:Cork; biomaterials: Hydroxyapatite (bone replacement) and polymers: Polyethylene (power cable insulation)

Objectives

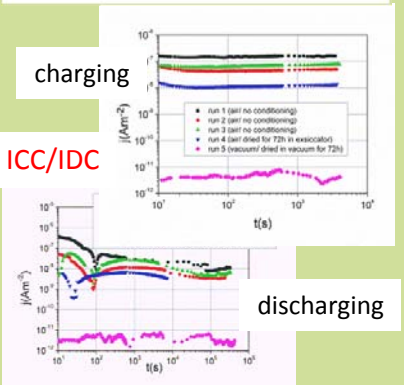
The material known as cork is the outer bark of Mediterrean Quercus suber L tree and an important Portuguese product. This project started as a collaboration with LNEG/Portugal where a composite of recycled cork and used TetraPak® cartons was developed recently. New applications would be added value in the market for this recycled material.
Since cork is a closed cellular material (in the micrometer scale cork is formed of closed cells filled with gas) it is possible that this new composite can be an insulator able to store space charge ⇒ Possible use as a (cellular) piezoelectric sensor? However the humidity content strongly affects this insulator character of this cork derivative and consequently its ability to store electric charge.





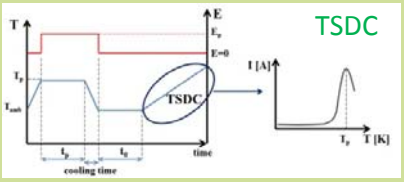
Methodology

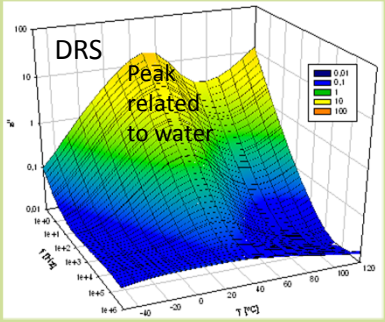
•Controlling water content to obtain better electric charge storage: Adding hydrophobic materials, such as paraffin or creating a layer with a hydrophobic polymer, such as low density polyethylene or conditioning the material by drying it.
• Accessing the ability to store charge by: Isothermal charge/discharge currents (ICC/IDC) and Thermally-stimulated discharge currents (TSDC) which allow to understand the trapping/detrapping mechanisms (activation energy and relaxation times).
•Dielectric relaxation spectroscopy (DRS), together with ICC/IDC and TSDC, are very powerfull techniques to investigate the influence of water on the insulator characteristics of the composite
•Add a piezoelectric material to the composite do enhance/obtain a higher piezoelectric response



Expected Results

Know the electrical and dielectric properties of cork, TetraPak® and the composite in order to understand electrical conductivity (or resistivity) of the new material.
Understand the influence of water content on the electrical conductivity of the composite.
Add suitable materials to the new composite in an attempt to tailor electrical and dielectric properties to obtain a material able to store electrical charge in the cells walls of cork.
Add a piezoelectric material to enhance piezoelectric properties and obtain a material with possible application as a piezoelectric sensor.





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