Desenvolvimento de materiais funcionais usando ferramentas eletroquímicas

Electrochemical tools for the development of functional materials

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Resumo: In this talk we will discuss the synthesis of new materials and/or properties employing the electrochemical approach. Several forms of activation energies can be used to promote the synthesis of an advanced material in the form of films, particles or even single molecules in solution. Electrochemical tools carries out this task using soft cell polarization values, typically of few volts, whereas the electrode-solution interface region has a high energy boundary condition. Besides, the electric field has a resulting vector direction which makes it different from, for example, a thermal activation synthesis procedure. In our group, using the anodization at room temperature, we have prepared different kinds of doped zirconium oxide films which present tetragonal phase. Employing a conventional ceramic route this phase is obtained only above 1000 ^{o}C. It is also be reported in the literature that the morphological characteristics of anodic oxides can controlled leading to self-organized pore or nanotube samples. We have observed also the presence of surface ferromagnetism in electrodeposited chromium films, whereas an antiferromagnetic behavior has been described for bulk samples. Furthermore, an intrinsic ferromagnetic phase in polythiophene derivative electrochemically prepared samples has been observed. From a different point of view, electrochemical tools are cheap and they can be coupled to different techniques to obtain a large amount of information. In this sense, our group has used “in-situ” optical microscopy together with electrochemical measurements to study the corrosion processes. Using this approach it was possible to estimate the pit depth change during the corrosion of steel and to study the electrochemical breakdown in the galvanostatic growth of ZrO_2. The use of electrochemical tools opens opportunities as the energy source for functional material synthesis which will be discussed in this presentation.

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