Synthesis and biophotonic applications of porous alumina micro and nanoparticles

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Abstract

Porous alumina is a very interesting material widely used in the development of optical and electronic devices specially due to its optical characteristics of reflectivity, transmission and its inherent photoluminescence [1,2]. So far porous alumina has been used as a substrate for many different applications such as biosensors, optical devices and as a template for other porous materials [3,4] but its versatility makes of it a suitable material for developing applications where particles of nanometric dimensions are required.

Nanoparticle research is an outstanding field in continuous development that recently has attracted great interest [5,6]. This increasing interest on nanotechnology manifested the necessity for developing materials with stable optical and physical characteristics, a high surface area and ease development in the nanometric range [7]. Porous alumina meets all these requirements and reveals as a potential material in this research field.

In this work we present the synthesis of porous alumina micro and nanoparticles and the analysis of their optical, physical and chemical characteristics. Different microscopic techniques are used for the characterization of the porous alumina particles like optical microscopy (Fig. 1), scanning and transmission electron microscopy (Fig. 2) and confocal microscopy (Fig. 3) together with other analytical techniques like Fourier Transform Infrared Spectrometry, electron backscatter diffraction and X-Ray diffraction. Their optical response is also studied by analyzing their transmission, reflection and photoluminescence spectrum. Besides, biophotonic applications of the porous alumina micro and nanoparticles are proposed here as they are a very stable and biocompatible material allowing an easy modification of its surface with organic components [8]. The nanometric size of the particles allows their absorption by the cells [9] that in addition to the intrinsic photoluminescence of the material makes of porous alumina nanoparticles ideal candidates for developing low-cost label-free specific biomarkers. Also, the controllable porosity of the material makes it suitable for developing drug delivery localized systems [10].

Acknowledgements

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References

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Figures

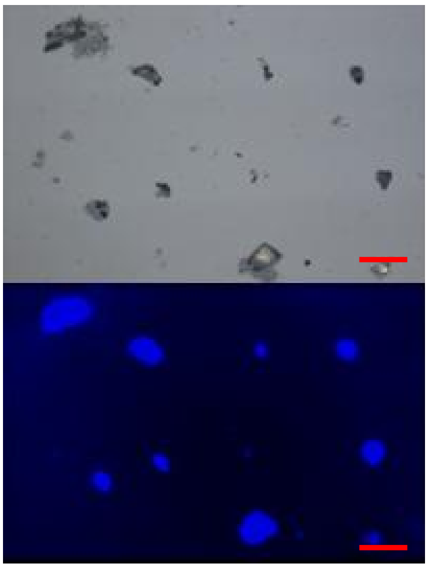

Figure 1. Optical microscope image of micrometric porous alumina particles a) white light b) photoluminescence. Scale bar: 10 um.

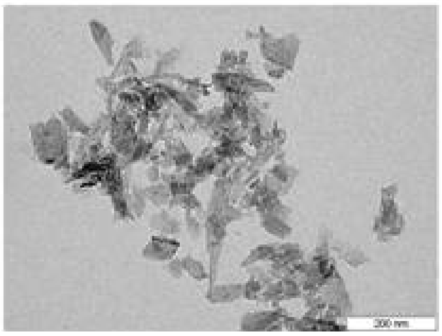

Figure 2. TEM image of nanometric porous alumina particles.

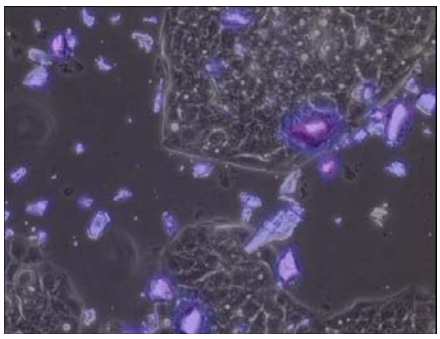

Figure 3. Confocal fluorescence microscopic images of HEPG2 cells incubated with micrometric porous alumina particles.