$ZnGa_2O_4:Cr^{3+}$ nanospheres with persistent luminescence: suitable candidates for biomedicine and optoelectronics

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Luminescent materials that are able to emit light long time after the excitation disappears are called persistent phosphors. They are easily found in decoration, safety signals or as road markers for almost 20 years. Nevertheless, using these phosphors for bioimaging, biosensing and anti-counterfeiting technologies, or even for optical data storage, has become in the interest most demanded currently [1]. For these novel applications, uniform persistent phosphors with nanometer size are required so that they can be either used as colloids, in the case of biomedicine, or as thin films inserted in the corresponding optoelectronic devices. $ZnGa_2O_4:Cr^{3+}$ (ZGC), with deep-red persistent emission, is one of the most studied persistent nanophosphors [2]. Most of the ZGC nanophosphors reported in the literature for bio-applications show, however, a rather non-uniform morphology [3]. Likewise, ZGC films have been fabricated by complex and expensive techniques [4].

In this study, we report a simple hydrothermal method to synthesize uniform, persistent ZGC nanospheres with tuneable size between 30 and 100 nm, that are useful for biomedicine and to prepare thin films using a single an inexpensive technique. The synthesis method consists of aging, at 200 ºC for 30 minutes, an aqueous solution of Zn nitrate (or Zn acetate), Ga nitrate, Cr nitrate and trisodium citrate in a microwave oven. The particle size can be modulated by changing certain experimental parameters. Transparent thin films can be easily fabricated from a suspension of the nanospheres using spin coating, which is a simple and economic technique (Fig. 1). The prepared films are able to emit in the deep-red region more than 1000 sec after the stoppage of excitation (Fig. 2), and are, therefore, ideal candidates for optoelectronic applications that require persistent luminescence [5].

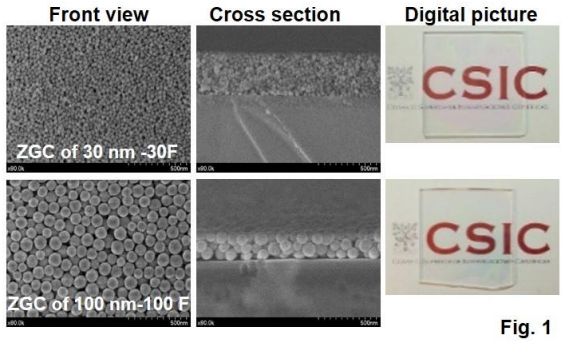

Fig. 1

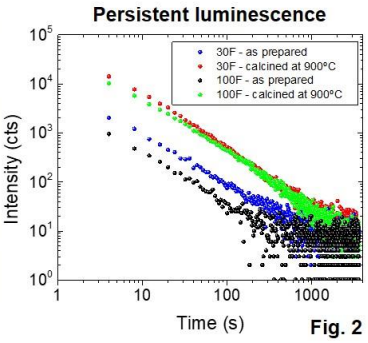

Fig. 2

Referencias

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