IOP PUBLISHING JOURNAL OF PHYSICS D: APPLIED PHYSICS

J. Phys. D: Appl. Phys. **42** (2009) 095102 (7pp) doi:10.1088/0022-3727/42/9/095102

**Structural and luminescent properties of**

**europium doped TiO2 thick films**

**synthesized by the ultrasonic spray**

**pyrolysis technique**

**E Zaleta-Alejandre**1**, M Zapata-Torres**1**, M Garc´ıa-Hip´olito**2**,**

**M Aguilar-Frutis**1**, G Alarc´on-Flores**1**, J Guzm´an-Mendoza**1 **and**

**C Falcony**3

1 Centro de Investigaci´on en Ciencia Aplicada y Tecnolog´ıa Avanzada-IPN; Legaria # 694, Col.

Irrigaci´on, Del. Miguel Hidalgo, M´exico D.F.

2 Instituto de Investigaciones en Materiales-Universidad Nacional Aut´onoma de M´exico; A.P. 70-360,

Coyoac´an 04510, M´exico D.F.

3 Centro de Investigaci´on y de Estudios Avanzados-IPN; Departamento de F´ısica, Apdo. Postal 14-470,

Del. Gustavo A. Madero, C.P. 07000, M´exico, D.F.

E-mail: ezaletaa@ipn.mx

Received 16 December 2008, in final form 14 February 2009

Published 15 April 2009

Online at stacks.iop.org/JPhysD/42/095102

**Abstract**

The structural and luminescent properties of trivalent europium-doped titanium dioxide films

synthesized by the ultrasonic spray pyrolysis technique at several substrate temperatures are

reported. These films are nanocrystalline and present a mixture of tetragonal (anatase and

rutile) crystal structures of the titania as determined by x-ray diffraction. The rutile crystal

structure became predominant as the substrate temperature during deposition was increased.

Under UV and electron beam excitation, these coatings showed strong luminescence due to f–f

transitions and the dominant transition was the hypersensitive 5D0 →7F2 red emission of Eu3+.

The photo- and cathodoluminescence characteristics of these films were studied as a function

of growth parameters such as substrate temperature and europium concentration. Excitation

with a wavelength of 396 nm resulted in photoluminescent emission peaks located at 557, 580,

592, 615, 652 and 703 nm, associated with the electronic transitions of the Eu3+ ion. The

photoluminescence (PL) intensity as a whole is observed to decrease as the deposition

temperature is increased. Also, with increasing doping concentration, a quenching of the PL is

observed. The chemical composition and surface morphology characteristics of the films are

also reported.