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Active waveguides made from porous anodic alumina filled with luminescent polymer: an optical sensor proposition

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Abstract – We present here the effects of an active waveguide build from porous anodic alumina (*PAA*) filled in or covered with luminescent polymer (*PFO*). The luminescence response was strongly modified by photonics properties of the Aluminum/*PAA-PFO*/air geometry which gives to this system advanced properties that can be applied in optical sensor field.

Nanoporous materials are attractive materials for optoelectronics, photonics and sensor applications. In special, porous anodic alumina (*PAA*) films comprise hexagonally packed pores with diameters at nanoscale dimension which occur naturally during Al anodization [1,2]. The geometric shape and porosity of the film matrix can be tailored by appropriate control of the anodization parameters [2] (Figure 1).

Different film morphologies were obtained using galvanostatic and potentiostatic technique and applying the two step anodization method for optimal porous homogeneity [1]. The photoluminescence was recorded from the lateral section of the Aluminum/*PAA*/*PFO* film using a 325 nm line of a He-Cd LASER.

We demonstrate that anodic alumina can be produced with variable porosity and exhibiting efficient near UV and visible luminescence at room temperature. The effects of an active waveguide constructed with porous anodic alumina (*PAA*) filled in with luminescent polyfluorine (*PFO*) is presenting in Figure 2. The luminescence response was strongly modified by the photonics properties of the Aluminum/*PAA-PFO*/air system. The planar waveguide formed by the reflecting aluminum substrate and the transparent layer of porous alumina is enough to couple very narrow (FWHM~3nm) and strong polarized transverse electric and transverse magnetic propagating modes from both the broad alumina emission and/or from emitting materials that fill their pores. This enhanced, self-selected waveguide emission originating from the host *PAA* or from the guest *PFO* inside the porous is completely tunable by the excitation wavelength. The spectral position and shape of the narrow waveguide modes is highly sensitive to the change of the effective optical thickness by the presence of the guest inside the pores. These findings make self-emitting porous alumina waveguides a promissory template for optical sensor applications.

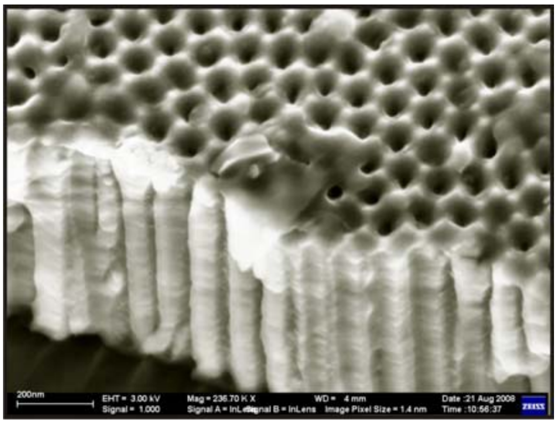

Figure 1: Exposed lateral view of the *PAA* film potentiostaticaly prepared by two anodization steps and the *PFO* deposited over it.

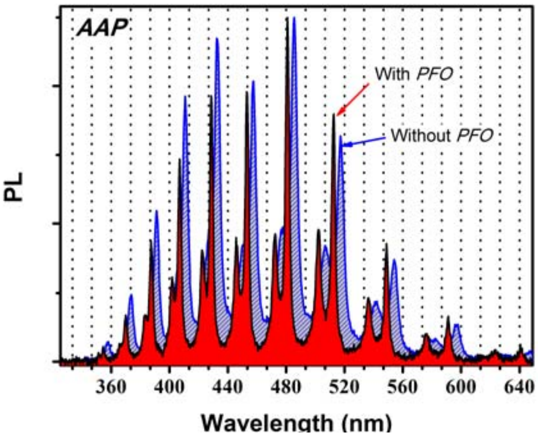

Figure 2: Comparison of the emission spectrum of pure *PAA* and *PAA/PFO* deposited over it. λ_{exc}= 325 nm.

References

[1] H. Masuda and F. Fukuda. Science 268 (1995) 5216-5218
[2] W. Lee, R. Ji, U. Gosele, and K. Nielsch. Nature Materials 5 9 (2006) 741-747