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Enhancement of photoluminescence of Rhodamine 6G infiltrated in oxidized porous Si by MPTS treatment

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To trap organic molecules within solid substrates a direct soaking of the host material into dye solutions has been widely used. In this work we have studied, the influence of 3-mercaptopropyltrimethoxysilane (MPTS) as a molecular binder between thermally oxidized Porous Silicon (PSi-Ox) and the Rhodamine 6G (Rh-6G) dye, in the photoluminescence of Rh-6G. The PSi layers have been prepared by electrochemical etching of single side polished p-type (100) Si wafers with resistivity of 0.01-0.02 Ω·cm, applying a current density of 20 mA/cm2 for 20 min. The etching solution contained ethanol (purity 99.5%), hydrofluoric acid (45%) and glycerol (99%) at volume proportions 60:30:10. The PSi layers exhibit 61% porosity and 21 μm thickness. All PSi samples were thermally oxidized at 300 °C with 10 ml/min oxygen flux for 2 h, in order to quench the PL of PSi. The PSi samples were divided in two sets. The samples of set 1 (PSi-Ox) were left as references while the samples of set 2 were silanized by dipping them into a solution containing 2.5 v/v of MPTS in 2-Propanol for 15 min. These samples are labeled (PSi-Ox-MPTS). Finally, both sets of PSi samples were infiltrated with a solution of Rh-6G and ethanol. The molar concentration of the Rh-6G in solutions was varied from 0.0 to 4.0 mM with 0.4 mM increment. In Fig. 1 the PL spectra of sample PSi-Ox-0.8Rh and PSi-Ox-MPTS-0.8Rh are shown. The Rh-6G is absorbed on the oxidized PSi layer probably due to its cationic character [1]. However, its PL intensity is low. From the figure it can be seen that the PL intensity of the Rh-6G infiltrated in the PSi-Ox sample is greatly enhanced when the oxidized surface is also silanized with 3-MPTS.

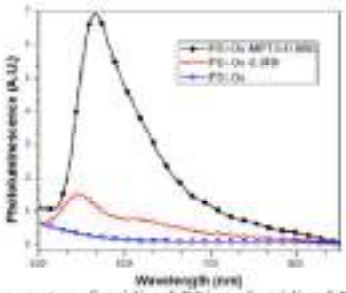

Fig.1 PL spectra of oxidized PSi, and oxidized PSi with/ without MPTS silanization and with Rh-6G infiltration.

Reference

[1] A. Chouket, H. Elhouichet, H. Koyama, B. Gelloz, M. Ouelati, N. Koshida. J. Thin Solid Films **518** (2010) 5212.

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