Luminescent composite system with potential random laser application

Caroline C. Alves[1*], José M. A. Caiut[1]

[11]*Departamento de Química, Faculdade de Filosofia Ciências e Letras de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto-SP, Brazil*

*e-mail: caroline.cassia.alves@usp.br

This work presents innovative approaches to the development of composite systems from a porous matrix aiming its use as potential random laser gain medium. Random lasers are optical structures in which light waves are both multiply scattered and amplified. In order to achieve this aim cellulose scaffolds were used as templates for the deposition of aluminoxane-epoxi-siloxane hybrids followed by thermic treatment with the formation of a 3D porous network. The composite was then soaked with a Rhodamine B ethanolic solution and left to dry at room temperature. The cellulose scaffolds were obtained by the viscose process[1], and Boehmite-GPTS (GPTS- glycidoxypropyltrimethoxysilane) hybrids have been prepared by the sol-gel methodology[2]. The cellulose scaffold is a porous material (Figure 1a), but the deposition of the hybrid material forms a thin layer (Figure 1b) which is transformed in a silica porous structure through thermic treatment (Figure 1c and 1d). When the laser dye Rhodamine B solution is added to the system, it is absorbed by the composite to act as gain medium. Each step of the composite preparation process was followed by Fourier Transform Infrared Spectroscopy (Figure 1e). The spectrum obtained for cellulose scaffold after hybrid deposition (E+H) presents similar bands to that of the hybrid alone (H). This means that a homogeneous layer was formed. After thermic treatment of the composite (E+H+TT) the surface is mainly composed of silica, as can be inferred by the bands at 3485cm^{-1} (O-H stretching) and 1067cm^{-1} (Si-O-Si stretching). Further analyses are being performed to detect a laser threshold behaviour.

References

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2. Caiut, J.M.A., et.al. *Journal of Non-Crystalline Solids* **2008**, *354*, 4795.

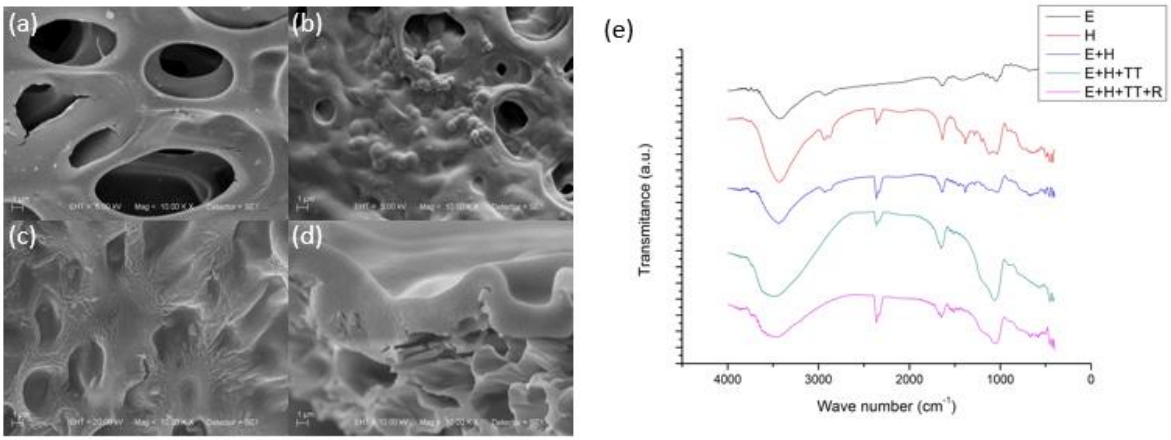

Figure 1 - Scanning electron microscopy of (a) the cellulose scaffold, (b) the cellulose scaffold after deposition of the hybrid, (c) the composite after thermic treatment, and (d) the lateral view of a cut in the material in (c); (e) Fourier Transform Infrared Spectroscopy of the different steps of composite preparation.