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Dye luminescent thin films prepared by plasma deposition

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Dye molecules embedded in different matrices in the form of thin films are the basis of specific materials used for laser cavities, optical filters, optical gas sensors, etc. Usually, the synthesis of this type of thin films is intended by sol/gel and similar wet methods and the films use to have a thickness of several microns. On the other hand, the vacuum deposition of dye molecules produces films formed by small light dispersing crystalline aggregates with very poor optical and mechanical properties.
In the present communication we discuss a new methodology based on the remote microwave plasma assisted deposition of dye containing thin films that circumvent the above mentioned problems [1-3]. It permits a tailored synthesis of optically active nanometric thin films containing dye molecules which are active as fluorescence emitters. The principle of this new procedure is the partial polymerization of dye molecules that are evaporated over a substrate while exposed to a remote microwave Ar plasma. Besides discussing the plasma deposition process, this communication presents some new results combining different dyes and matrix composition. Examples are shown of novel plasma nanocomposites containing non-aggregated perylene dyes and other molecules. The plasma deposition protocol can be adjusted to maximize the fluorescent emission of the materials [1, 2] and to optimize the fabrication of optical NO_2 sensing nanocomposites [3]. Further possibilities of this new plasma method are discussed in relation with the use of the luminescent films for sensing and other photonic applications [4].

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[4] New photonic systems on a chip based on dyes for sensor applications scalable at wafer fabrication (PHODYE EU Project) http://phodye.icmse.csic.es

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