Assembly and Properties of QDs Thin Films

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Quantum dots (QDs) are semiconductor that have recently attracted extensive interest due to their unique photoelectrochemical properties which can be placed between those of bulk semiconductor materials and those of isolated molecules or atoms. QDs are increasingly applied in bioanalytics and optoelectronics [1]. The photophysical and catalytic properties can be adjusted by changing the size of nanoparticles [2] or by changing the functional groups of molecules capping on the nanoparticles [3]. QDs at the air–water interface result in the formation of 2D Langmuir films. Advantages of this assembly technique include establishing limiting nanoparticle area, easy manipulation of the films, and interparticle distance control. To be utilized in solid devices, the QDs should be immobilized onto solid substrates. Langmuir-Blodgett (LB) films are prepared from Langmuir monolayers at the air-water interface therefore we need to know the properties of these monolayers.

In the present study, surface self assembled systems such us cationic gemini $C_{18}H_{37}$ $(CH_3)_2N^+$-$(CH_2)_2$-$N^+(CH_3)_2$ $C_{18}H_{37}$, (18-2-18) and the PMAO polymer. These systems are used as linking procedure to anchor the QDs onto substrates. The thermodynamic properties of these self assembled materials were investigated by surface pressure-area (Π-A) isotherms of the QDs monolayers. The morphology of films at the air-water interface was observed by Brewster Angle Microscopy (BAM). Langmuir-Blodgett (LB) films of QDs on solid substrates were characterized by Atomic Force Microscopy (AFM) and Transmission Electron Microscopy (TEM). The fluorescent properties of the LB film were also studied by Steady State Fluorescence Measurements.

The results obtained show that the morphology and properties of the films depend on the self assembled system employed to bind the QDs on the substrate. In addition the structures formed using different systems induce changes in the photophysical properties of the nanomateriales as is observed in the fluorescence emission of the LB nanomaterials.

References

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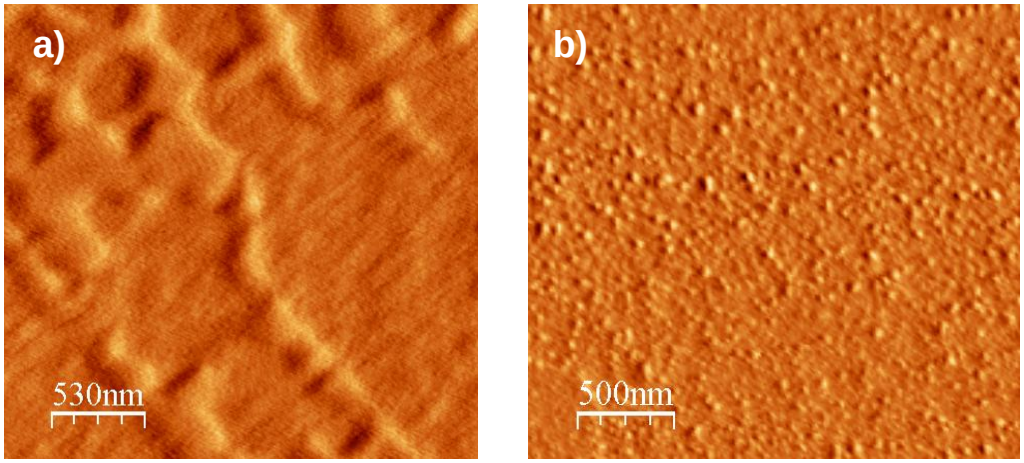

Figure 1 AFM images of mixtures QDs/18-2-18 (a), bilayer: QDs film onto 18-2-18 monolayer (b)

Acknowledgement:

The authors thank financial support from ERDF and MEC (MAT 2010/19727, MAT2007/62666) and from Junta de Castilla y León (SA138A08). The authors want to thank especially to Drs J.A. Pérez-Hernández and J. Hernández-Toro for the AFM measurements and C.L.P.U. (University of Salamanca) for the AFM facility.