

REVERSIBLE COLLAPSE OF INSOLUBLE MONOLAYERS

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The collapse of a mixed insoluble monolayer formed by a cationic matrix (DOMA) and a tetra-anionic porphyrin (TSPP), in a molar ratio TSPP/DOMA=1:4, has been studied. For this system, and under compression above the collapse surface pressure, the formation of circular domains consisting exclusively of trilayer has been observed.[1] Moreover, it has been detected that at the final collapse state the interface is not completely covered by domains, but those trilayer domains are coexisting with regions of only one layer. Such coexistence cannot be exclusively interpreted in terms of thermodynamic phase equilibrium, but the role of the line tension of the formed domains should be taken into account. A high line tension implies a high resistance to the deformation and the lack of coalescence between domains. For our system these two phenomena have been experimentally observed by BAM. In these circumstances, i.e. for a high line tension, the domains of collapsed material could enclose monolayer regions where the collapse is stopped due to a sharp drop of the surface pressure inside of these regions. The collapse of the TSPP/DOMA system is reversible, i.e. the return from the collapsed material to the monolayer also fits to a simple kinetic according to the nucleation-growth-collision theory [2]. As for the collapse, the reverse process is affected by the line tension of the domains, although an additional factor is involved: the area per molecule in the monolayer is larger than in the trilayer. Under these conditions, the formation of monolayer holes inside of the domains is highly unlikely because the domain should expand, and it would need a sizable energy. This work links the high line tension of the domains, which prevents their coalescence, with the reversible nature of the collapse [3].

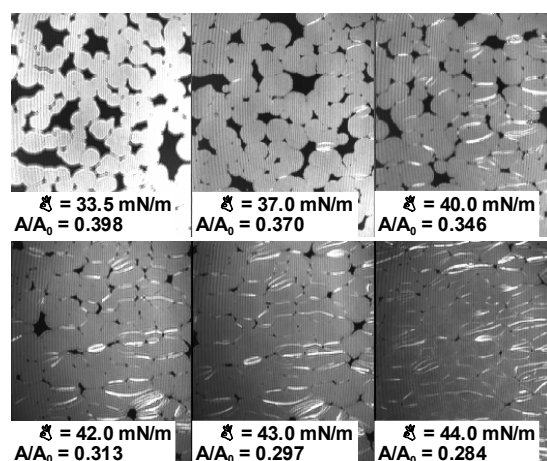


Figure 1. BAM images at different surface pressures showing the lack of coalescence between the TSPP/DOMA domains

References:

- [1] Pérez-Morales, M., Pedrosa, J.M., Martín-Romero, M.T., Möbius, D., Camacho, L. *J. Phys. Chem. B* **108**, 4457-4465 (2004).
- [2] D. Vollhardt, U. Retter, *J. Phys. Chem.* **95**, 3723-3727 (1991)
- [3] González-Delgado, A., Perez-Morales, M. Giner-Casares, J.J. Muñoz, E., Martín-Romero, M.Y., Camacho, L. *J. Phys. Chem. B* **113**, 13249-13256 (2009)