Interfacial characterization of soap films used as artificial photosynthetic membranes

Y. Timounay [1]
A. Benarouche [1], A. Cagna [1], R. Franklin [2], A. Hassanali [2], A. Pannwitz [3], M. Hoefnagel [3], D. Klein [3], S. Bonnet [3], I. Sen [4], G. Falciani [5], E. Chiavazzo [5], S. Rodriguez-Jimenez [6], V. Philip Cazin [6], E. Reisner [6]

[1] Teclis Scientific, France
[2] ICTP, Italy
[3] Leiden University, Netherlands
[4] Uppsala University, Sweeden
[5] Politecnico di Torino, Italy
[6] UCAM, United Kingdom

E-mail: yousra.timounay@teclis-scientific.com

ABSTRACT

Soap films are fragile objects with a limited lifetime, however, their proton transport properties and the self-assembling property of surfactants at their interfaces make them strong candidates for Artificial Photosynthesis (AP) where energy from sunlight is stored in chemical bonds of a solar fuel and O_2 is liberated as by-product. In the Sofia project [1,2], the aim is to use soap films as AP membranes by doping liquid-gas interfaces with newly synthesized functional molecules and eventually expand the concept to the foam-scale. In addition to being regenerative, soap films are economic compared to the complex and highly technological AP systems reported in the literature [3,4].

In this context, we have characterized the interfacial properties of these doped photocatalytic interfaces through surface tension measurements and 2D-rheology analysis. Moreover, the interaction between the newly synthesized catalysts/photosensitizers with the stabilizing surfactant, $C_{12}E_6$, has been investigated and the effect of their cohabitation on the stability of soap films has been assessed. Finally, the permeability of $C_{12}E_6$ laden films to CO_2, one of the gases involved in the photosynthesis process, is characterized through diffusion experiments.

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