

Spontaneous Multilayering in Langmuir Films of Ionic Liquids at the Air-Water Interface

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Many of the potential applications of ionic liquids (IL) involve processes that take place at interfaces, either at the liquid-vapour interface of a pure IL or solution, or at the surface of other liquids and solids. The study of the interfacial properties of ILs, pure or in solution, is therefore of utmost importance for the development of their technological applications, since their properties can be significantly different from those of the bulk liquids. Despite its obvious importance, the knowledge of the structural properties of ILs at the air/water interface is still quite poor. A better understanding of the behaviour of ILs at this interface can be obtained studying the formation of thin films through the Langmuir and Langmuir-Blodgett techniques. To date, this is a largely unexplored field. To the best of our knowledge, the only existing studies are those of Bai et al¹ and Mukherjee et al.². However, the first study focused essentially on the practical objective of obtaining gold nanoparticles, while the latter addresses the general amphiphilic behavior of the studied ILs. As a result, the structure and stability of the corresponding Langmuir films remains practically unstudied. In this work we have studied the behaviour of a number of ILs of the methyl-imidazolium family at the air-water interface using the Langmuir and Langmuir-Blodgett techniques. Additionally, molecular dynamics simulations have been performed to obtain molecular level insight on the structure of the films. In the case of [octadecylmim][NTf₂] and [octadecylmim][Cl] we have obtained for the first time evidence of the spontaneous formation of multilayers of these ionic liquid at the air-water interface. The overall behavior of the films is quite complex.

References

- [1] X. Bai, et al. *Cryst. Growth Des.* 8 (2008) 3840–3846.
- [2] I. Mukherjee et al. *Journal of Colloid and Interface Science* 395 (2013) 135–144.