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Louise Deschênes, Johannes Lyklema, François St-Germain

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Entropy of Aqueous Surfaces. Application to Polymeric Langmuir Films

Louise Deschênes[a*], Johannes Lyklema[b] and François St-Germain[a]

[a] Saint-Hyacinthe Research and Development Centre, Agriculture and Agri-Food Canada, 3600 Casavant Blvd.West, QC, Canada, J2S 8E3.

[b] Department of Physical Chemistry and Soft Matter of Wageningen University and Research, Helix Building Stippeneng 4, 6708 WE, Wageningen, Netherlands.

*Corresponding author. Fax: 450-768-7851. Tel: 450-768-7960. Email: louise.deschenes@agr.gc.ca

Abstract

Measuring surface (excess) entropies provides a bounty of valuable structural information that is hard to obtain otherwise. In the paper these quantities are defined and procedures of measurements discussed. Mostly they involve measurements at different temperatures. A review is given for interfaces with aqueous solutions in the absence of polymers. This review illustrates how, sometimes unanticipated, pieces of information are obtained, for example with cloud seeding and a possible explanation of the Jones-Ray effect. As a novel extension the procedure is applied to deposited, or Langmuir, monolayers of poly(ethylene oxide)-poly(propylene oxide) block copolymers. It will be shown how the various phase transitions and associated configurations of these polymers can be recognized and monitored.

Keywords

Surface entropy, surface tension, Langmuir monolayers, PEO, PPO, Jones-Ray effect

1. Introduction

This paper is written in appreciation of Dominique Langevin at the occasion of her 70th birthday. We acknowledge her many enlightening contributions to colloid and interface science, in particular those involving fluid interfaces. We hope she will be pleased with the thermodynamic work to be described below, because it gives additional structural insight in systems to which she has recently contributed. Recent papers that she has (co-)authored, some of a review nature, include references [1-5]. They demonstrate her continued activity and versatility. For the present theme we will mainly focus on surface excess entropies, because these are carriers of structural information. After reviewing some examples in the absence of polymers, we shall discuss polymeric monolayers, one of our joint interests [4, 5].