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## Influence of polymer structure in solution on the impedance of adsorbed monolayers for electronic tongue sensors

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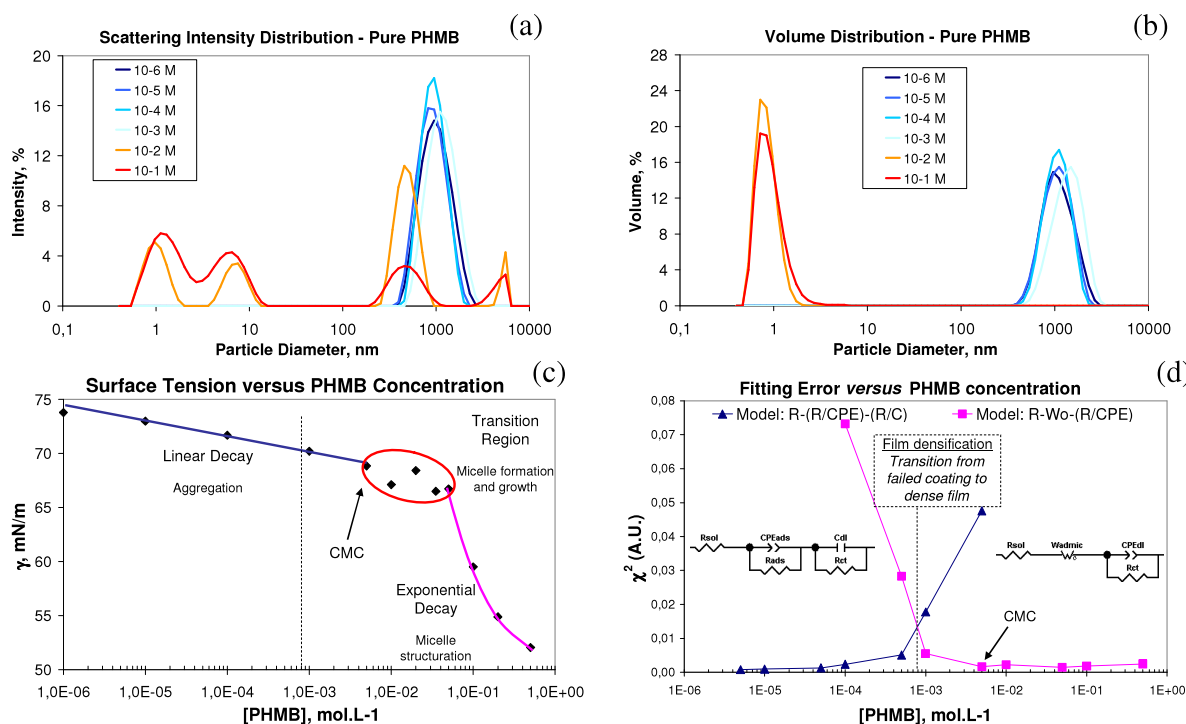
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**Abstract** – Monolayers of PHMB [Poly(hexamethylene biguanide hydrochloride)] were formed on interdigitated electrodes to evaluate the influence of polymer concentration on the impedance behavior. Pendant drop goniometry, dynamic light scattering and electrochemical impedance spectroscopy were used to probe the structure of polymer in water. Micellization and long-range aggregation were responsible for distinct deposition regimes yielding distinct impedance equivalent circuits.

PHMB, a cationic polyelectrolyte [1], adsorbs over gold electrodes in a fashion controlled by its structure in solution. At low concentration, large aggregates deposits irregularly over the surface leading to a failed coating, allowing solvent to freely access the electrode surface. When concentration approaches a critical value, near but above critical micelle concentration (CMC), the film suffers a transition from a failed coating to a rough, denser coating, covering the electrode surface and modulating the electrochemical impedance through diffusion over the polymeric layer. These findings, although yet preliminary, are very relevant to explain the effect of physical-chemical parameters affecting not only the electrochemical responses of taste sensors made of such material but also help a better understanding of the layer-by-layer self-assembly of films made from this and similar materials.



**Figure 1:** (a) Scattering intensity distribution showing evolution of aggregates at low concentration of PHMB, to small particles (micelles) at higher polymer concentration. (b) Volume distribution showing that from  $10^{-2}$  M to above almost all particle volume is composed by small micelles of 0.5 to 5.0 nm of diameter. (c) Surface tension of pure PHMB solution, showing CMC around  $5 \cdot 10^{-3}$  M, in accordance with DLS measurements. (d) Quality of fitting for electrical circuits equivalent to impedance measurements of pure PHMB solutions, showing a critical point where both models fails to explain the impedance behavior of a electrode-film-solution system composed of interdigitated gold electrode, adsorbed PHMB and water.

[1] G. C. East, J. E. McIntyre, J. Shao, Polymer 38 (1997) 3973-3984