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VIBRATIONAL SPECTROSCOPY STUDY OF PLURONIC-WATER INTERATIONS IN RELATION TO MICELLISATION AND GELATION

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Pluronics is a commercial name for a group of compounds that are tri-block copolymers of poly(ethylene oxide)-poly(propylene oxide)-poly(ethylene oxide) or PEO-PPO-PEO. They are non-ionic macromolecular surfactants, which have wide industrial use in detergency, drug solubilisation and controlled release, in burn wound covering and many other.

Gelation of tri-block copolymers is a macroscale effect linked to mesoscale (micellisation) and nanoscale (conformation) effects, but these links have not been firmly established so far. In an attempt to study correlations of effects at different scales, we have chosen water solutions of three Pluronic macromolecules with the same length of the hydrophobic segment (31 units) but varying lengths of the hydrophilic segments. We have studied compound F68 that has the longest hydrophilic segment – 81 ethylene oxide units, and compounds PE6200 and PE6400 where the length of the PEO segment is 5 and 14 respectively.

It is the polymer-solvent interaction that decides the structure of polymer networks, their conformation and macroscopic properties. Due to the polymer-water interactions we can differentiate between bulk, interstitial and hydration water. We have studied the behaviour of water interacting with the Pluronic molecules by means of Raman, infra-red (ATR) and near-infrared (NIR) spectroscopy. Raman spectroscopy especially showed differences in the relative intensity of collective band in the OH stretching region of water even at temperatures below the critical micelle temperature. This band, located around 3250 cm^{-1}, is sensitive to the presence of molecular solutes that may disturb (hydrophilic solutes) or enhance (hydrophobic solutes) hydrogen bonds between water molecules. Other effects such as bandshifts and change in intensity of bands other than the collective band of water observed by all three methods (Raman, ATR and NIR) are also discussed.