

INSTITUTE OF PHYSICAL CHEMISTRY  
BULGARIAN ACADEMY OF SCIENCES  
SOFIA, BULGARIA

# **O/W EMULSION FILMS FROM POLYMERIC SURFACTANT BASED ON INULIN**

Gochev G., Exerowa D., Khristov Khr., Kolarov T.,  
Tadros Th. F., Leveck B.

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**”Nanoscale Phenomena and Structures in Bulk and Surface Phases”  
( NANOPHEN )**

To investigate the stability of O/W emulsions from graft copolymer based on Inulin in presence of electrolyte

To find the conditions for obtaining stable O/W emulsion films from this surfactant and to make correlation with the real emulsions

To study the interaction forces, which are responsible for the stability of the emulsion films

*The Microinterferometric Method of Scheludko and Exerowa*

was used for the film thickness measurements

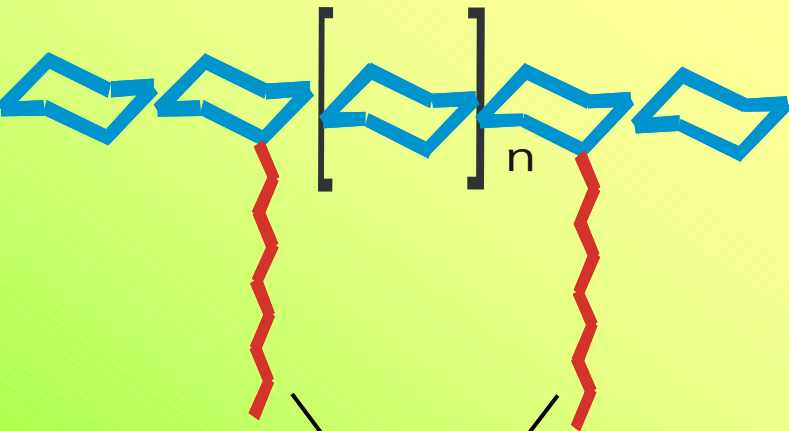


Diblock copolymers



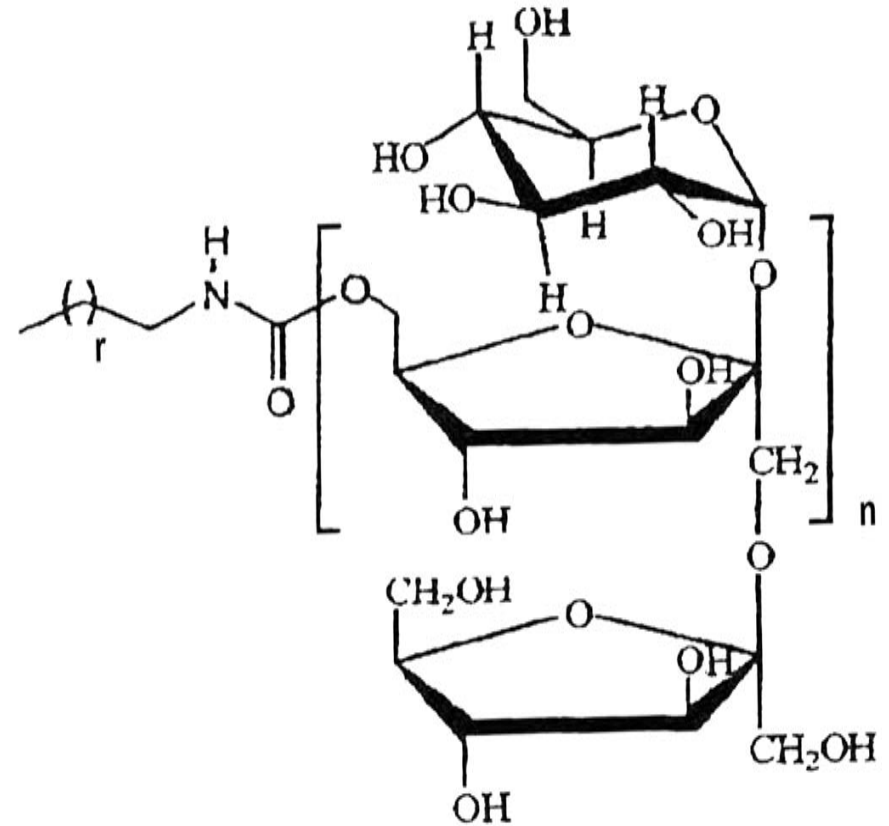
Triblock copolymers

Graft Copolymers

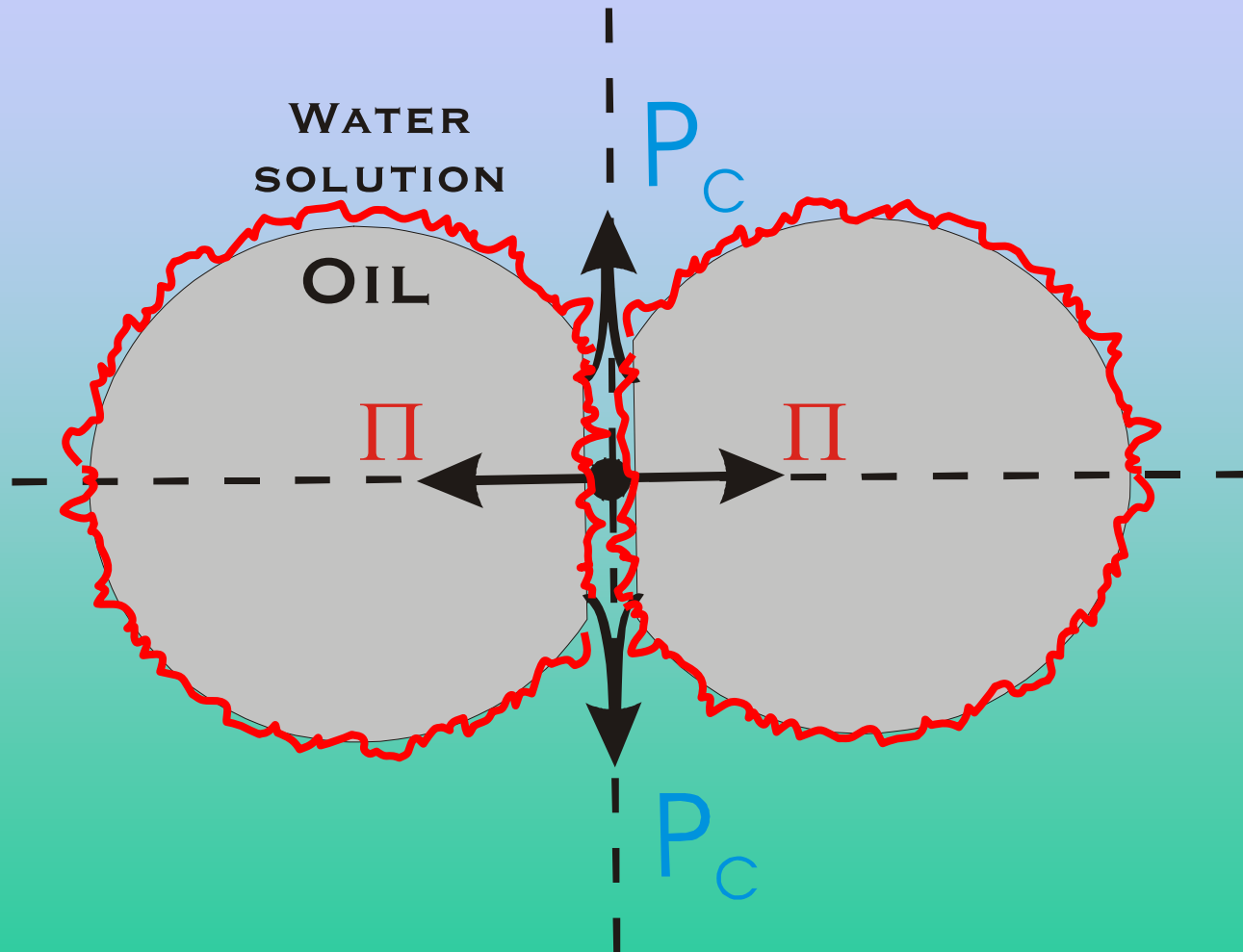


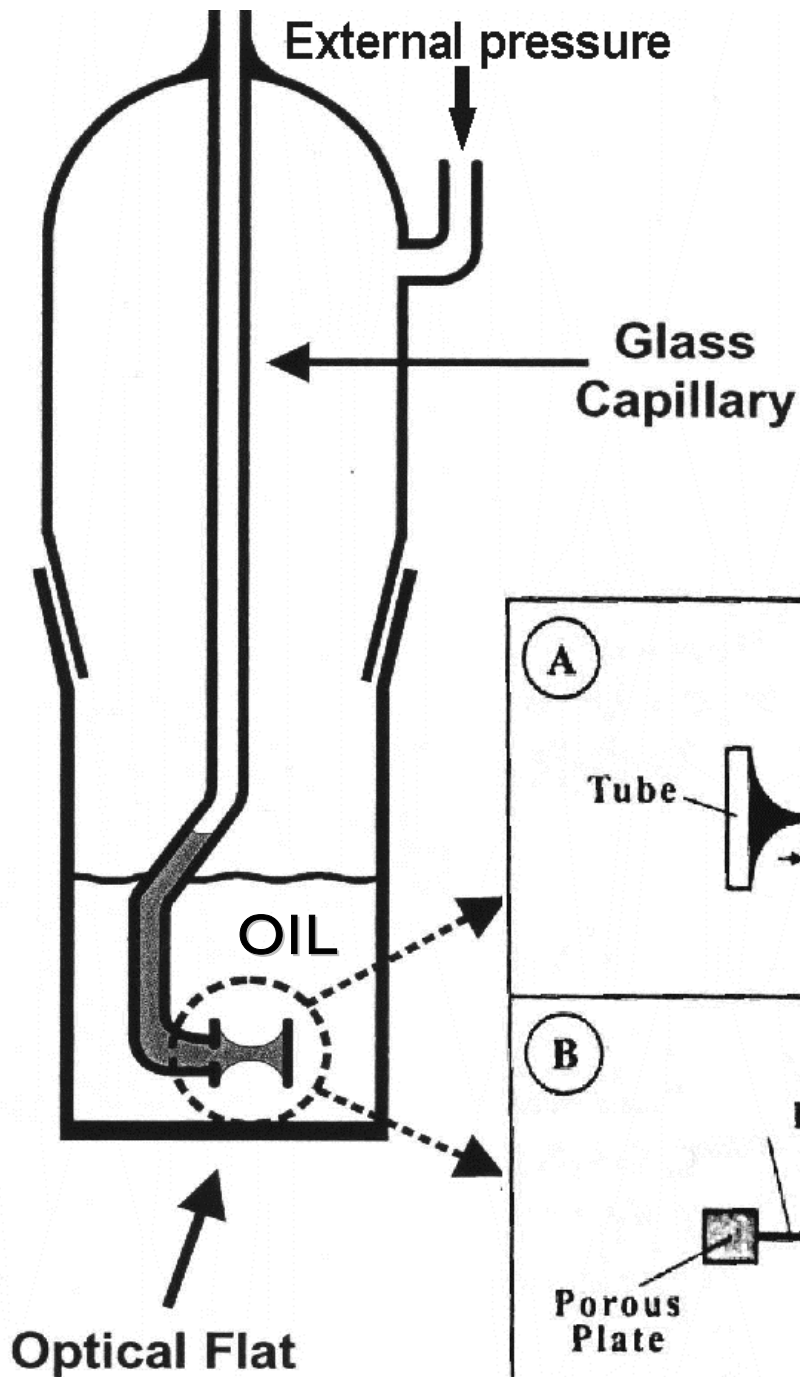
grafted alkyl groups  
to a polymeric chain

Source: *Th. F. Tadros et al. ( 2004 )*



INUTEK® SP1,  
non-ionic amphiphile  
macromolecule  
based on inulin





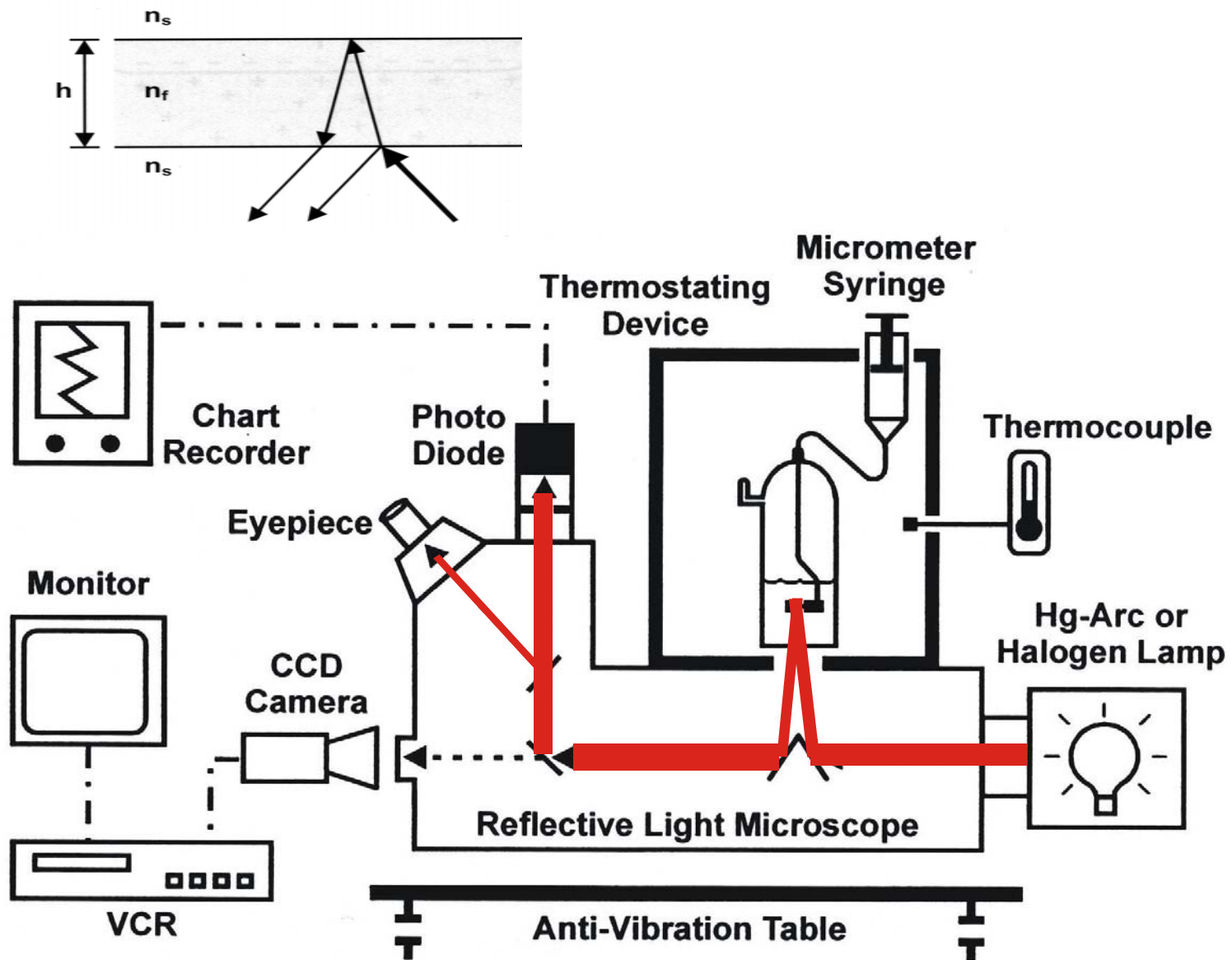
$$T = \text{const},$$

$$\Pi = P_c = \text{const}$$

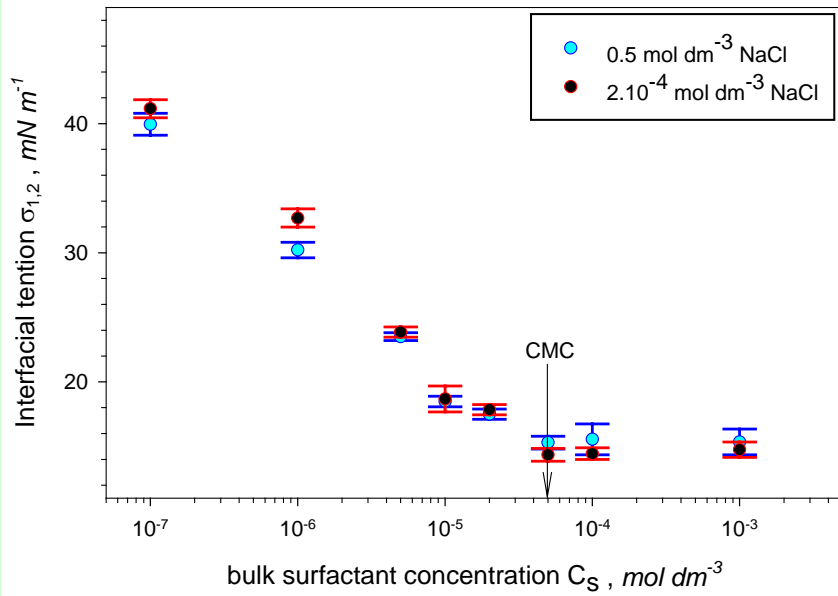
$$T = \text{const},$$

$$\Pi = P_c + P_{\text{applied}}$$

***TLF-PBT***



Scheme of the set-up  
for equivalent film thickness measurements

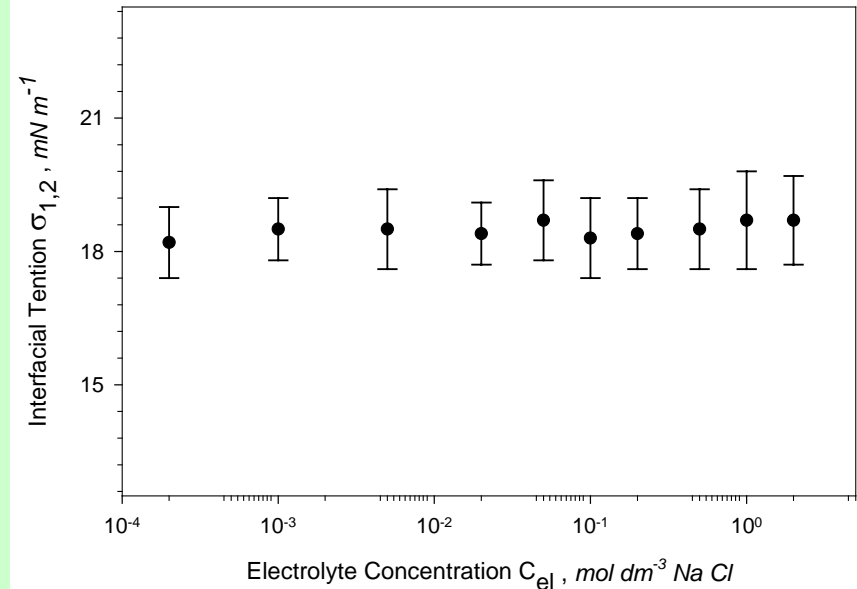


## Interfacial Tention - measured by method of *de Nouy*

$$\text{CMC} = 5 \times 10^{-5} \text{ mol dm}^{-3}$$

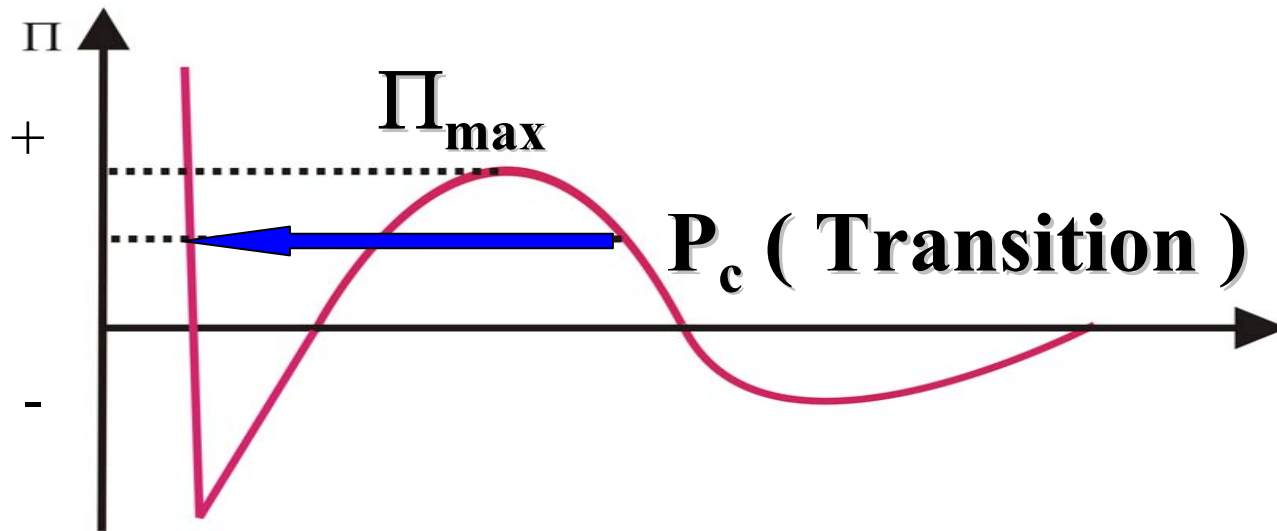
$$C_s = 2 \cdot 10^{-5} \text{ mol dm}^{-3}$$

No influence  
of the electrolyte  
on  $\sigma_{1,2}$  values  
at const  $C_s < \text{CMC}$



# DLVO-theory curve of $\Pi ( h_f )$ isotherm

(  $T = \text{const}$  )



$$P_c = \Pi = \underbrace{\Pi_{\text{el}} + \Pi_{\text{vw}}}_{\text{DLVO}} + \underbrace{\Pi_{\text{st}} + \dots}_{\text{NON-DLVO}}$$



$$\Pi_{el} = 64 C_{el} RT y_0^2 \exp(-\kappa h)$$

$$\kappa = \sqrt{(8\pi z^2 F^2 C_{el}) / (\epsilon RT)}$$

$$y_0 = \text{th}[zF\phi_0 / (4RT)]$$

**1/κ**

the thickness of  
the diffusive part of the EDL

$$\Pi_{el} \sim e^{-\kappa h}$$

$$C_{el} \uparrow \leftrightarrow \Pi_{el} \downarrow$$

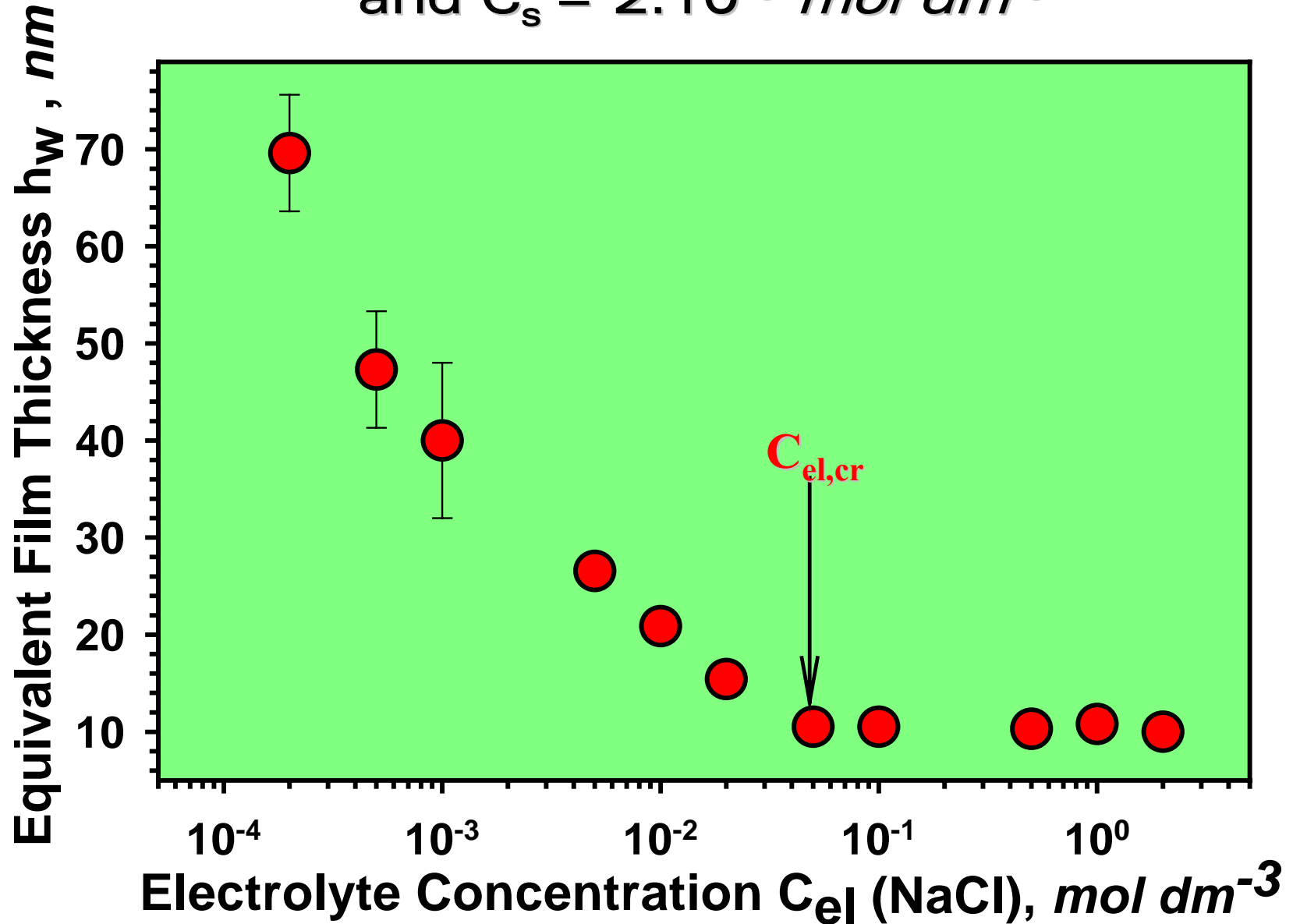
$$\Pi_{vw} = -K_{vw} / h^n \quad n = 3 \text{ or } 4$$

**Microscopic theory**

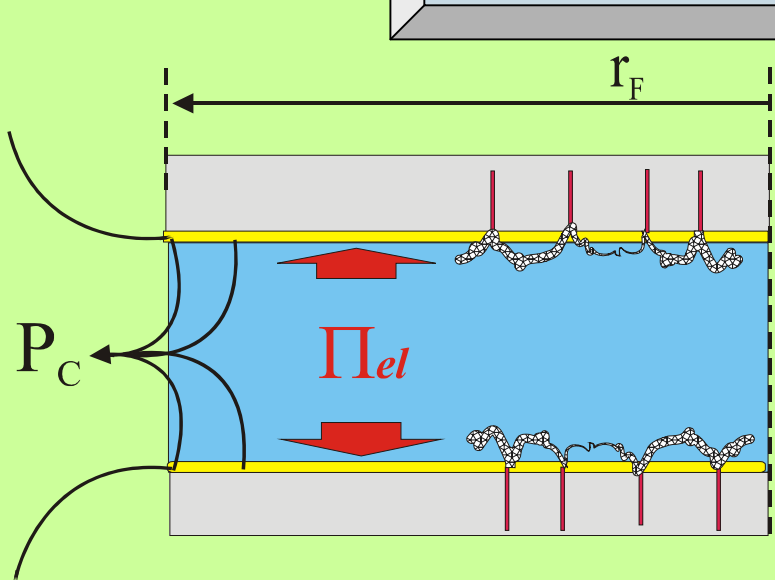
$$\Pi_{vw} = \frac{hc}{h^4} \frac{\pi^2}{240\sqrt{\epsilon_0}} \left( \frac{1 - \epsilon_0}{1 + \epsilon_0} \right)^2 \varphi \left( \frac{1}{\epsilon_0} \right)$$

**Macroscopic theory**

$h_w (C_{el})$  isotherm at constant  
capillary pressure  $P_c = 38 \text{ Pa}$   
and  $C_s = 2 \cdot 10^{-5} \text{ mol dm}^{-3}$



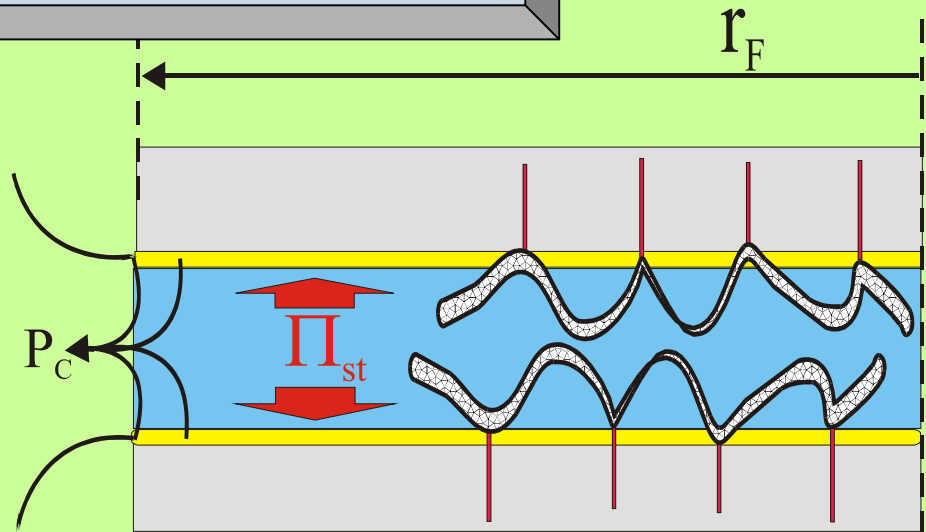
# Three layer model



Common Films  
( CF )

15 – 80 nm

*electrostatic repulsion*



Common Black Films  
( CBF )

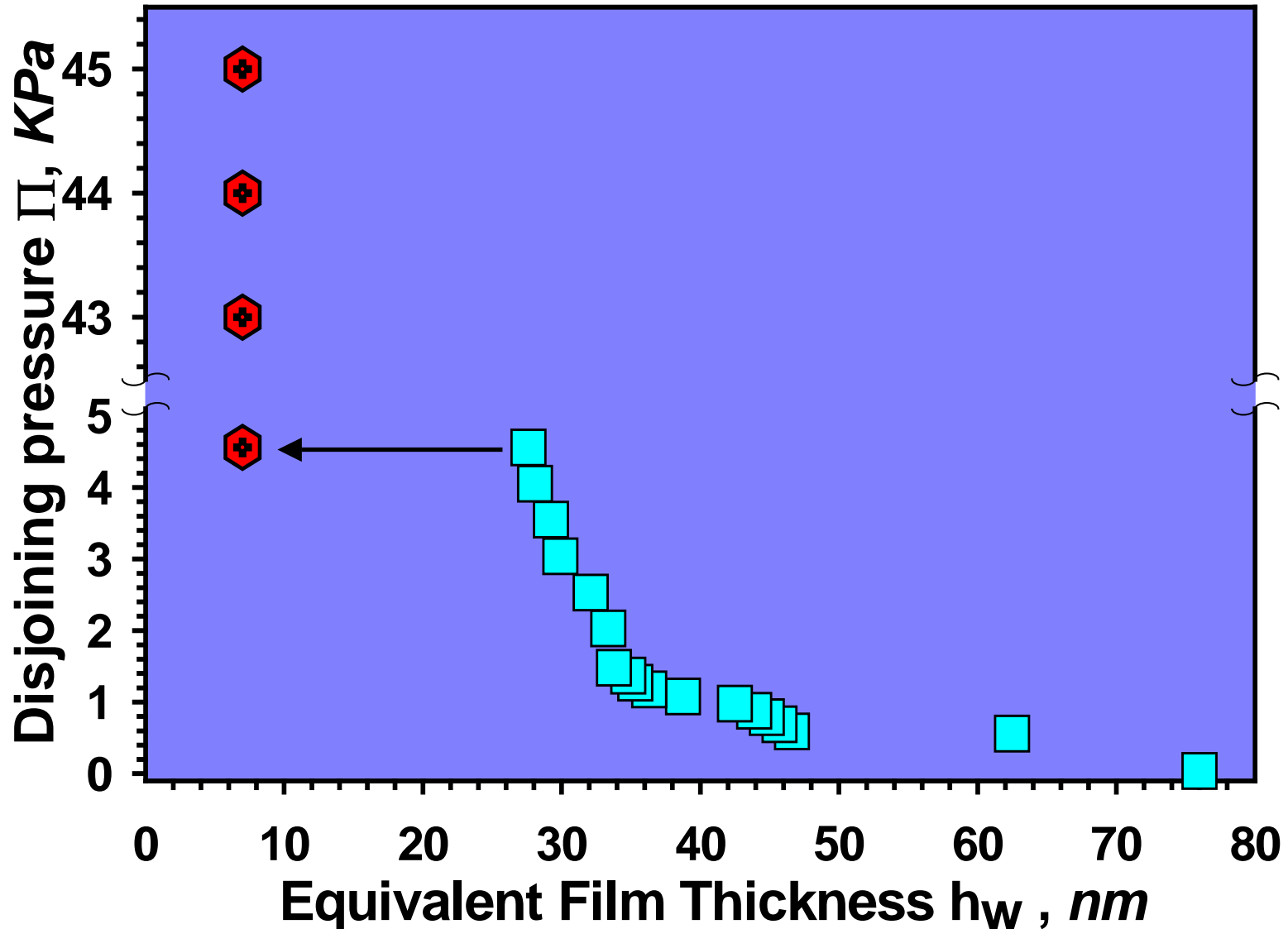
10 – 11 nm

*steric repulsion*

$\Pi$  ( h ) isotherm

$$C_s = 2 \cdot 10^{-5} \text{ mol dm}^{-3}$$

$$C_{el} = 2 \cdot 10^{-4} \text{ mol dm}^{-3}$$



$\Pi ( h )$  isotherm  
 $C_s = 2 \cdot 10^{-5} \text{ mol dm}^{-3}$

