

# **ELECTRODE COATING WITH ORGANIZED ULTRATHIN FILMS FOR BIOSENSOR APPLICATION**

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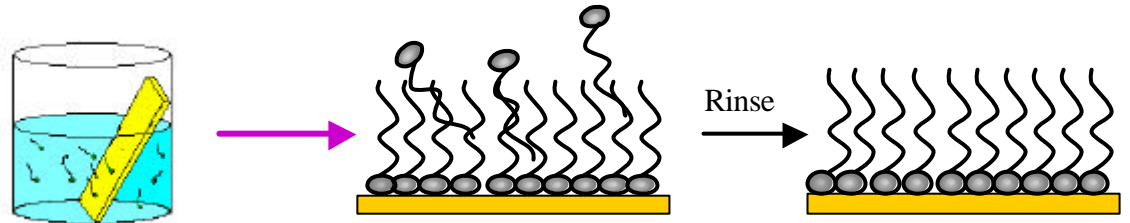
# INTRODUCTION



**Electrode modification** by means of molecular ordered film coating:

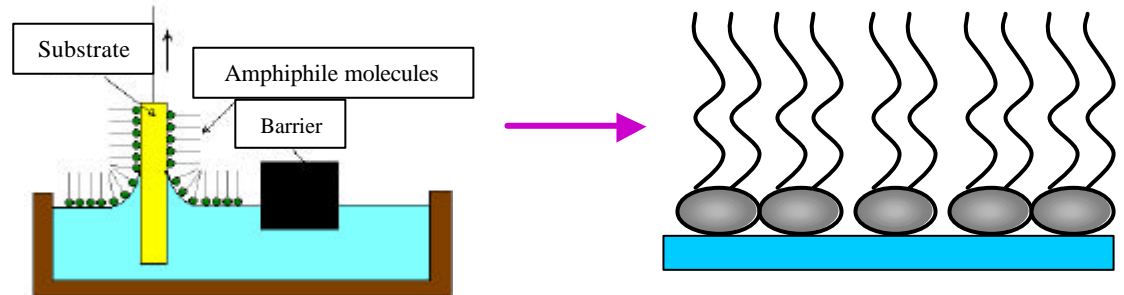
## SAMs (Self-Assembled Monolayers):

Molecular ordered systems obtained by chemisorption of an amphiphile on a solid substrate



## LB (Langmuir-Blodgett) films:

Molecular ordered systems mechanically assembled building-up oriented monolayers on a solid support by means of repeated loops of extraction-immersion at controlled speed



## HF (Hybrid Films) SAM/LB:

Molecular ordered films obtained by deposition of a LB film on top of a previously self-assembled layer



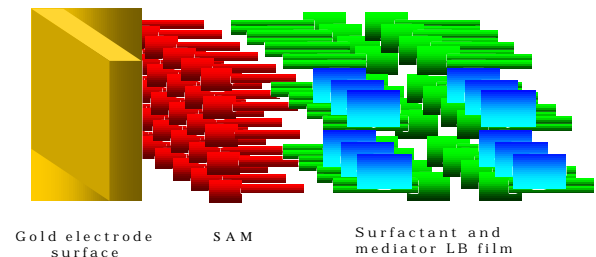
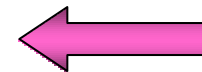
**Immobilization of electroactive molecules (redox mediators) for biosensor application**



**Characterization** (electrochemical and spectroscopical)

of the film in order to:

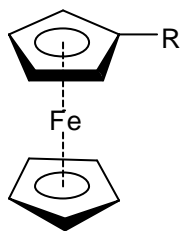
- Verify the presence of the mediator
- Investigate its electroactive behaviour



# MATERIALS

and

# METHODS



R = H

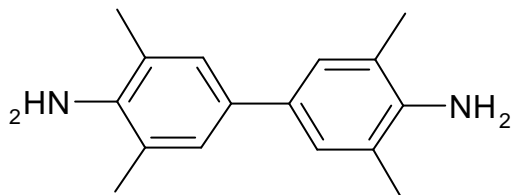
Ferrocene

(Fc)

R = COOH

Ferrocene carboxylic acid

(Fc-COOH)



3,3'-5,5' Tetramethylbenzidine (TMB)

## REDOX MEDIATORS

### Surface pressure measurements

KSV5000 LB System

### Ellipsometry

Rudolph Research Ellipsometer (Mod. 437-02)

### Contact Angle measurements

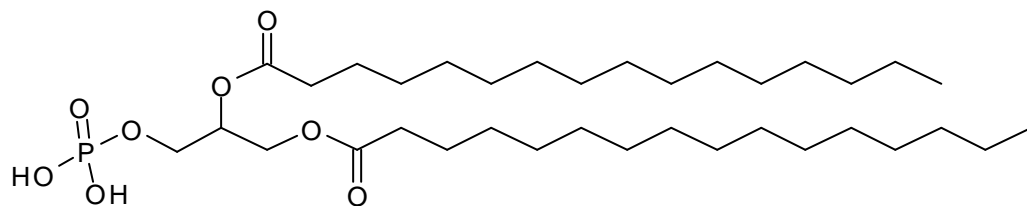
Ramé-Hart Automated Contact Angle Goniometer

### Cyclic Voltammetry

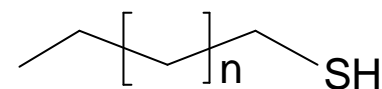
Ecochemie Autolab (Mod. PG STAT 10)

### UV-Vis Spectroscopy

Perkin Elmer Lambda 900 Spectrometer



Dipalmitoylphosphatidic acid (DPPA)



n = 5

Octanethiol  $\equiv$  OM

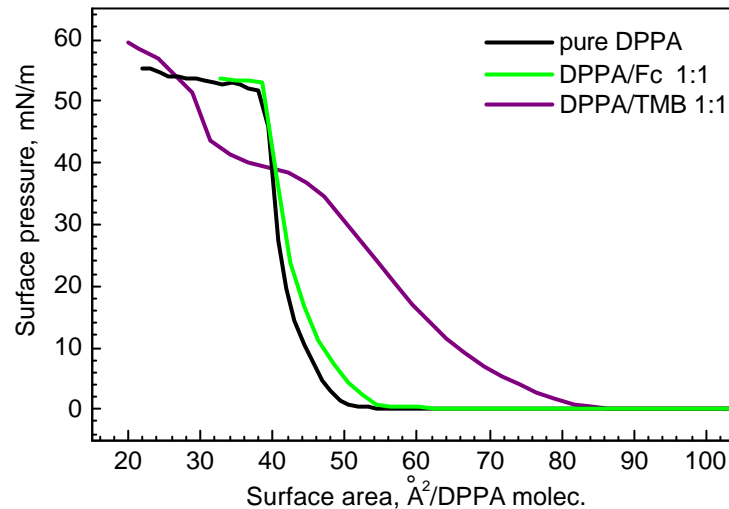
n = 15

Octadecylthiol  $\equiv$  ODM

## AMPHIPHILIC MATRICES

# WATER-AIR INTERFACE: co-spreading of redox mediators with DPPA matrix

Spreading isotherms of DPPA/Fc and DPPA/TMB as a function of mediator molar fraction in the mixture

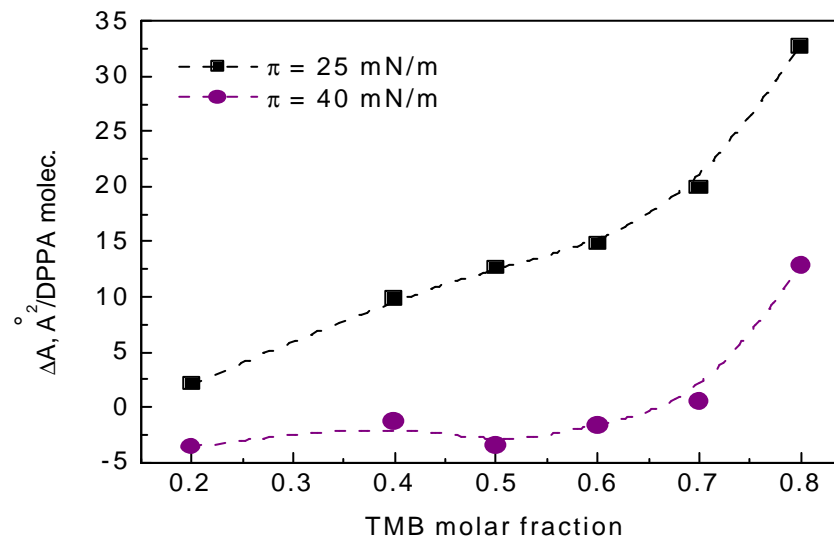


**Fc:**  
irrelevant displacement of  $\pi$ -A isotherm (as well as Fc-COOH)

**TMB:**  
significant displacement of  $\pi$ -A isotherm up to  $\pi^* = 36$  mN/m

**TMB IMMOBILIZED  
IN THE DPPA MONOLAYER  
UP TO  $p^*$   
(phase transition)**

Variations in DPPA/TMB molecular areas with respect to pure DPPA before  $p_{tr}$  ( $\pi = 25$  mN/m) and after  $p_{tr}$  ( $\pi = 40$  mN/m)



**AFTER  $p_{tr}$  TMB IS  
SQUEEZED OUT  
THE MONOLAYER  
(except DPPA/TMB 1:4)**