

# CONSTRUCTION, CHARACTERIZATION AND APPLICATIONS OF SINGLE COMPONENT CROSS-LINKED MULTILAYERS OF POLY(VINYL AMINE)



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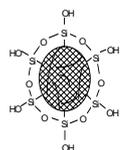
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## AIM

Preparation of novel porous single component multilayer films of poly(vinyl amine) as a potential reservoir for proteins

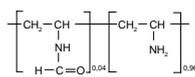
- STEPS**
- Multilayer construction by alternately adsorption of PVAm and PAA, onto silica particles and silicon wafers;
  - The selective cross-linking of the PVAm in the multilayers with epichlorohydrin (ECH);
  - The removal of PAA from cross-linked multilayers in basic media;
  - Sorption of proteins onto single component cross-linked multilayers.

## Materials



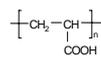
**Silica**  
Particle diameters: 15 - 40  $\mu\text{m}$ .  
Pore diameters: 4 - 6 nm.

**Silicon wafers (Si/SiO<sub>2</sub>)**  
Surface ~ 1  $\text{cm}^2$ .



**Poly(vinyl amine) (PVAm)**

( $M_w$ : 15000 and 340000  $\text{g}\cdot\text{mol}^{-1}$ )



**Poly(acrylic acid) (PAA)**

( $M_w$ : 11000 and 57000  $\text{g}\cdot\text{mol}^{-1}$ )

## Characterization methods

Polyelectrolyte and potentiometric titrations



UV-VIS Spectroscopy



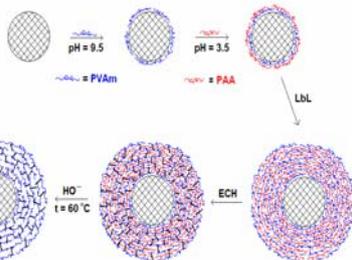
Atomic Force Microscopy (AFM)



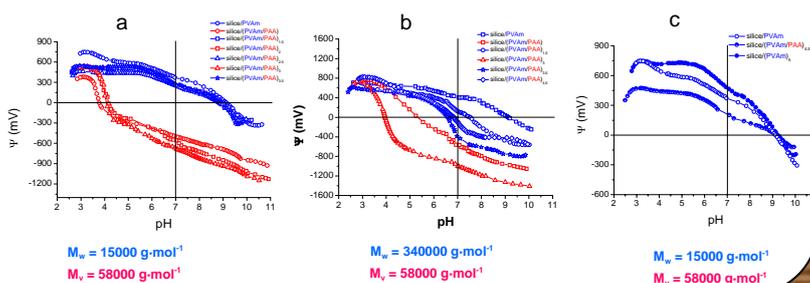
Contact angle measurements



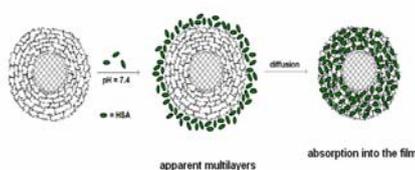
## Schematic representation of the formation of the cross-linked (PVAm)<sub>n</sub> thin films onto silica microparticles



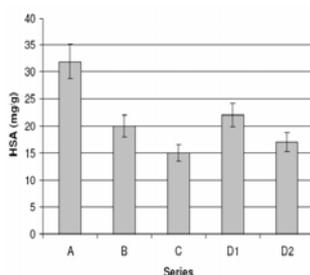
## Potentiometric titration of silica/(PVAm/PAA)<sub>n</sub> before (a, b), and after extraction of PAA (c)



## Schematic representation of the interaction of protein and cross-linked (PVAm)<sub>n</sub> films



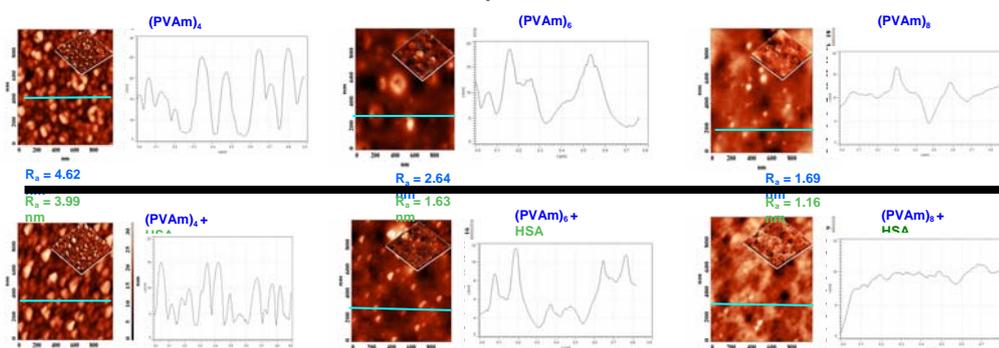
The amount of HSA adsorbed onto (PVAm)<sub>n</sub> multilayer film as a function of the polyon pair: A, low PVAm/high PAA; B, high PVAm/low PAA; C, high PVAm/high PAA; D1, high PVAm/low PAA, (PVAm)<sub>6</sub>; D2, high PVAm/low PAA, (PVAm)<sub>11</sub>



Contact angle and standard deviation of the single component multilayer thin films before and after the adsorption of HSA as a function of the number of PVAm layers

n	(PVAm) <sub>n</sub>	(PVAm) <sub>n</sub> + HSA	
		vacuum-dried	freeze-dried
4	88.8 ± 1.0	87.0 ± 0.4	85.5 ± 0.4
6	95.3 ± 1.2	85.6 ± 0.7	85.1 ± 0.7
8	95.0 ± 0.2	87.3 ± 0.8	89.2 ± 0.1

## Tapping mode height AFM images (2D and 3D) and profiles of cross-linked single component (PVAm)<sub>n</sub> multilayer thin films deposited on silicon wafers, before and after the sorption of HSA.



## CONCLUSION

- A regular LbL construction of thin films on silica particles was observed by potentiometric titration when low PVAm and high PAA were used as polyon pair, with the highest amount of protein being adsorbed onto the (PVAm)<sub>n</sub> film thus constructed.
- The decrease of contact angle with 6 - 8 grades when the HSA has been loaded on the films containing 6 and 8 layers of PVAm shows the increase of the film hydrophilicity, the protein being adsorbed inside the porous single component film.
- The images obtained by tapping mode AFM of the topography of the (PVAm)<sub>n</sub> thin films showed a decrease of both  $R_a$  and  $R_q$  with the increase of the PVAm layer number.

## REFERENCES

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