Designing performant spectroscopic biosensor via in situ functionalization

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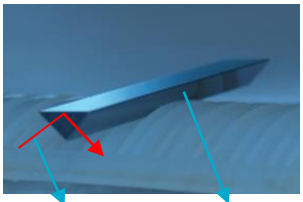
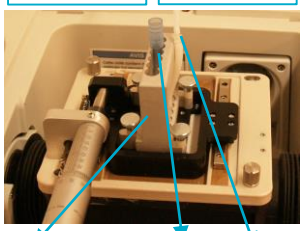
Introduction – FTIR/ATR

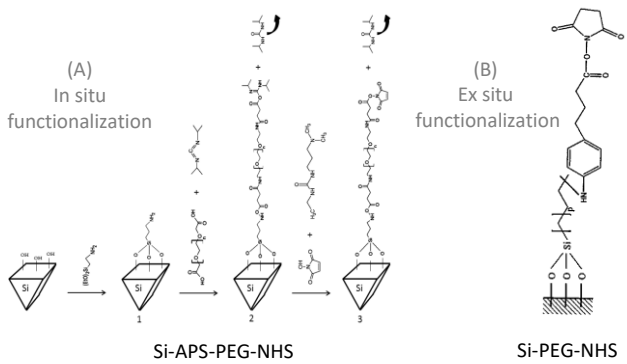
Advantage ATR:

1. Enhance the quality of signal
2. Increase the energy
3. Short acquisition time



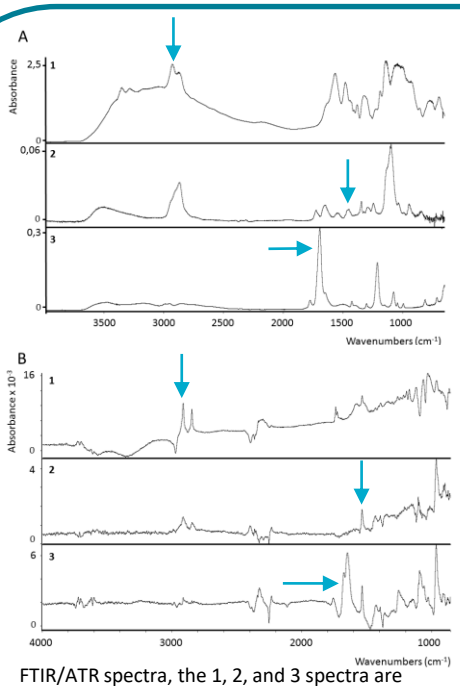


Functionalization silicon surface



[A1]: APS surface was performed through the reaction of silane with surface hydroxyls.
[A2]: Acid carboxylic terminal groups of dPEG molecules reacts with amino surface to give an antifouling coating, covalently attached, which will be able to form two steric barriers surrounding the PEG chain.
[A3]: Upon addition of NHS we obtain a surface sensor efficient to react with primary amine.

Results & discussion



FTIR/ATR spectra, the 1, 2, and 3 spectra are respectively the coatings related to the APTES, dPEG and NHS. [A]: spectra reference [B]: spectra obtained during the functionalization

Surfaces	Average amount of reactive molecules anchored (Absorbance)		Mean signal (Absorbance)		Mean noise (Absorbancex10-3)		SSNR not normalized	SSNR normalized
	Peak area	SD	Peak area	SD	Peak area	SD		
Si-APS-PEG-NHS (A)	0,39	0,14	1,7	0,25	11,84	3,02	143	368
Si-PEG-NHS (B)	1,45	0,21	2,51	0,3	23,42	4,61	107	74

SSNR = Spectroscopic Signal to Noise Ratio
SD = Standard deviation
(A) Based on new method of functionalization
(B) Based on method previously used

It seems less reactive BUT:

- The sensitivity is greatly improved
- More exploitable infrared area
- Steric barriers => no undesirable reaction => More specific

Conclusion

- Efficient grafting method of silicon surfaces useful for biosensor applications
- Directly performed in flow cell while, in the same time, monitoring in real time using FTIR spectroscopy => Total control
- Reduction the standard deviation
- Exceptional properties in terms of stability

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