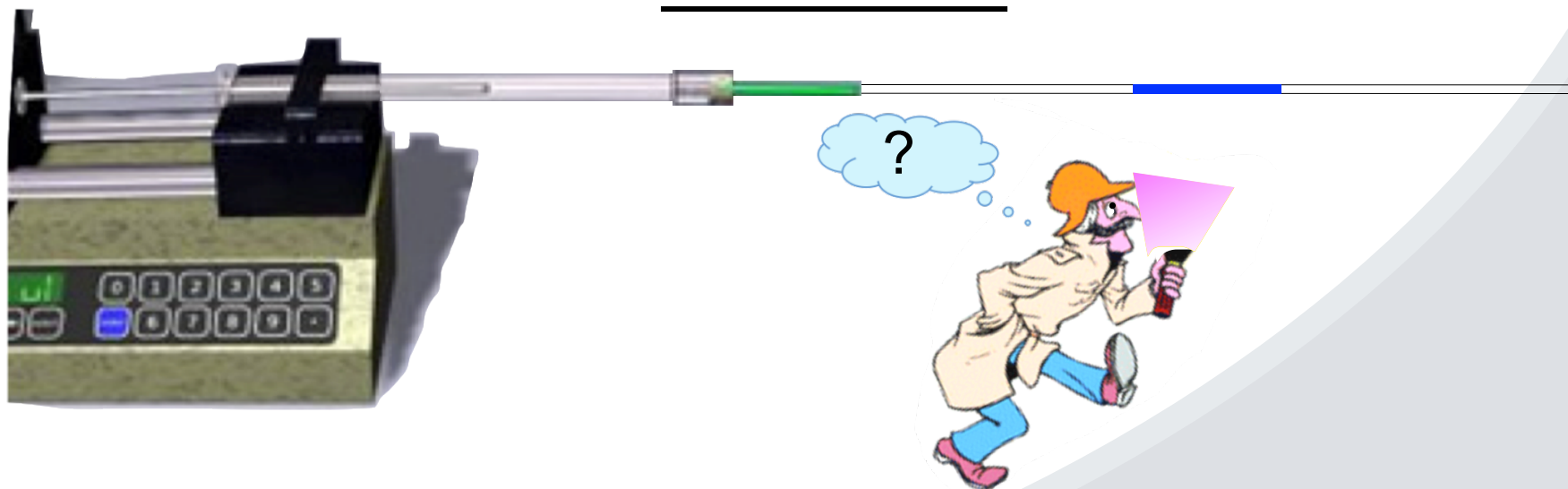


Photo-Detection of Solvent Polarities Using Non-invasive Coatings in Capillaries

Larisa Florea



EUROSENSORS - 8.09.2011

Outline

- Background
- Spiropyran based monomer
- Spiropyran polymeric brushes in micro-capillaries
- Photo-detection of solvents of different polarities
- Conclusions

Outline

Background

SP-monomer

SP-polymer
Brushes

Solvent
Sensing

Conclusions

Stimuli-responsive Materials

Materials whose characteristics can be changed using an external stimulus

Thermal

Mechano

Photo

pH

Chemo

Outline

Background

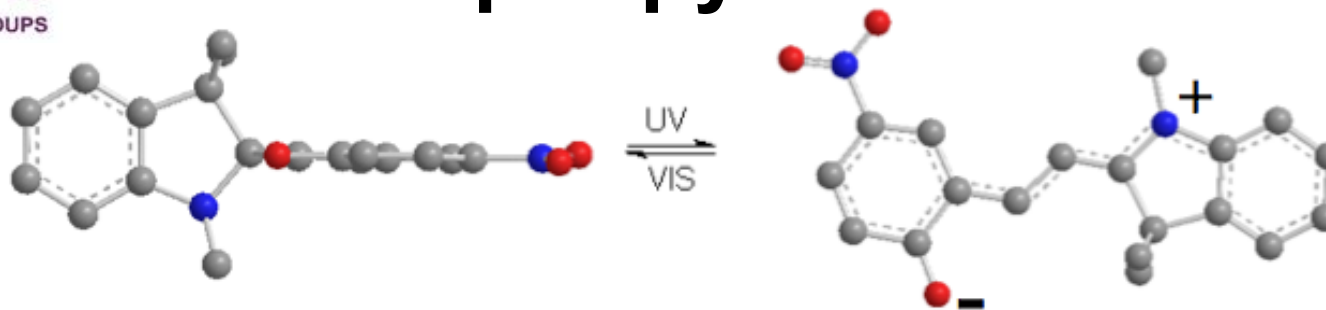
SP-monomer

SP-polymer
Brushes

Solvent
Sensing

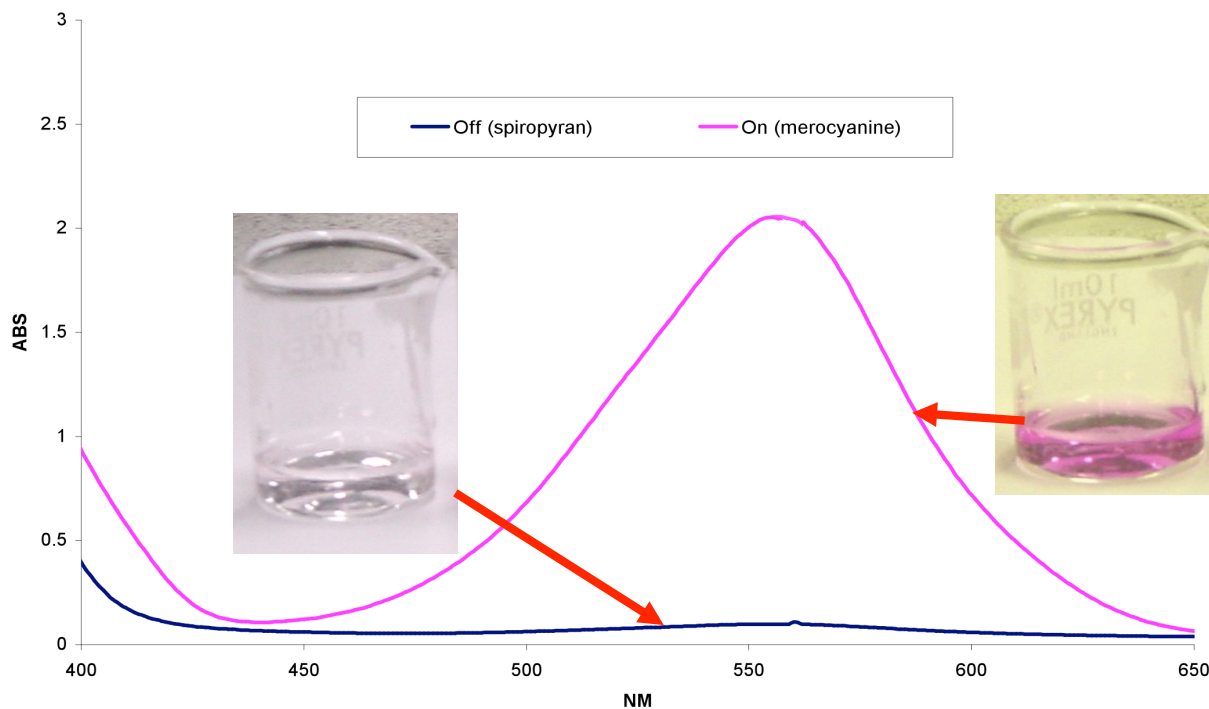
Conclusions

Spiropyran



A : Spiropyran SP (closed, colorless)

B : Merocyanine MC (open, colored)



Outline

Background

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Brushes

Solvent
Sensing

Conclusions

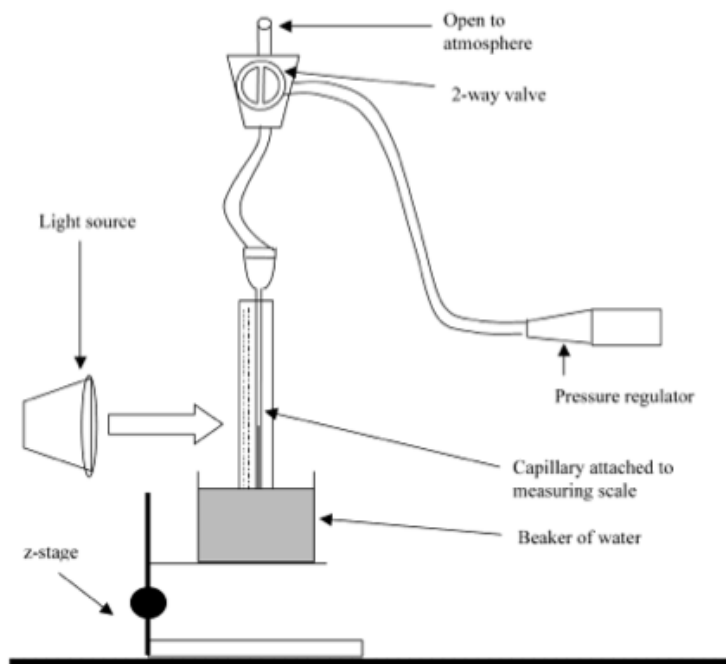


Fig 1. Experimental setup for measurement of capillary rise in a spiropyran monolayer functionalised capillary [1].

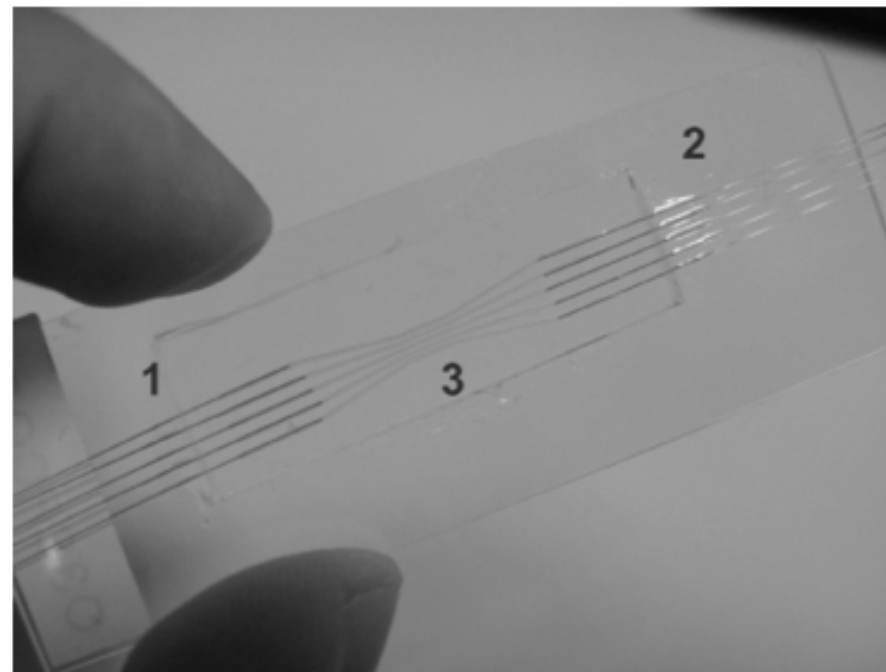


Fig 2. PDMS/glass hybrid micro-fluidic device functionalised with a monolayer of spiropyran molecules [2].

Low loading of spiropyran molecule

[1] R. Rosario et al. / Langmuir, 18 (2002) 8062-8069

[2] F. Benito-Lopez et al. / Sensors and Actuators B 140 (2009) 295–303

Outline

Background

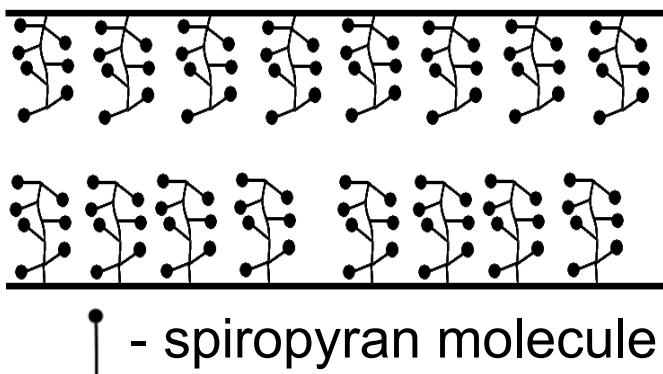
SP-monomer

SP-polymer
Brushes

Solvent
Sensing

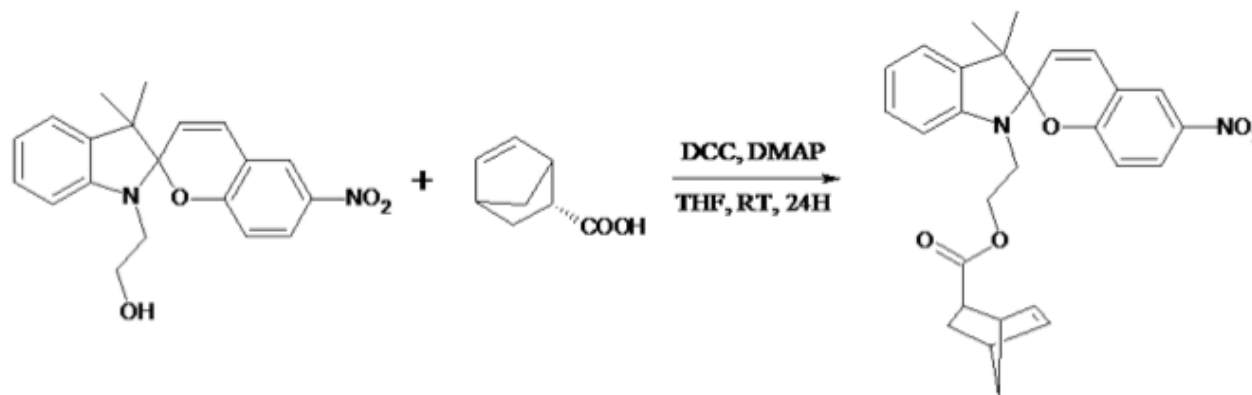
Conclusions

Micro-capillary : Convenient platform for rapid analysis and detection



- mechanical support for the optically sensitive layer
- represents an optical waveguide structure
- suitable for real-time continuous flow analysis
- requires very small volume of analyte

Synthesis of Spiropyran Monomer



SP

SP-M

Outline

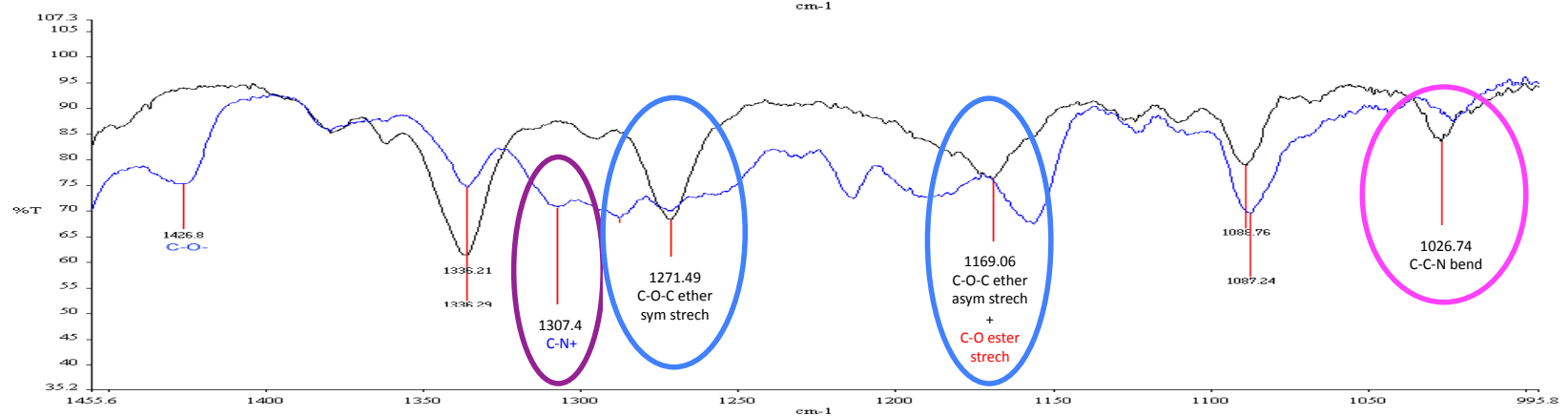
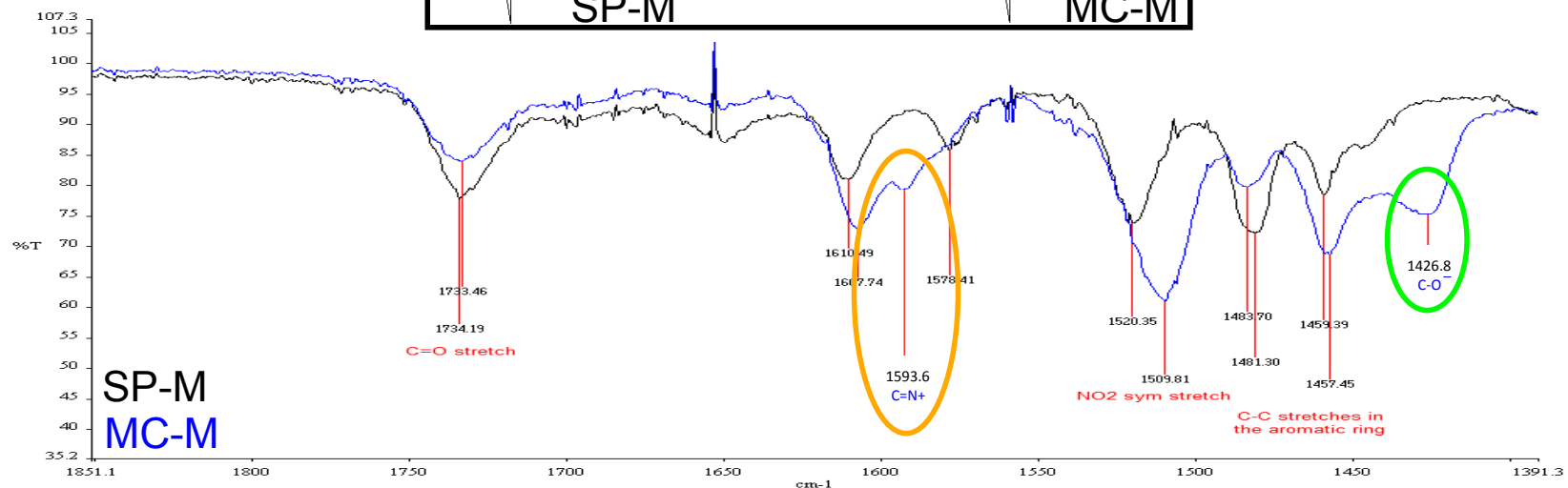
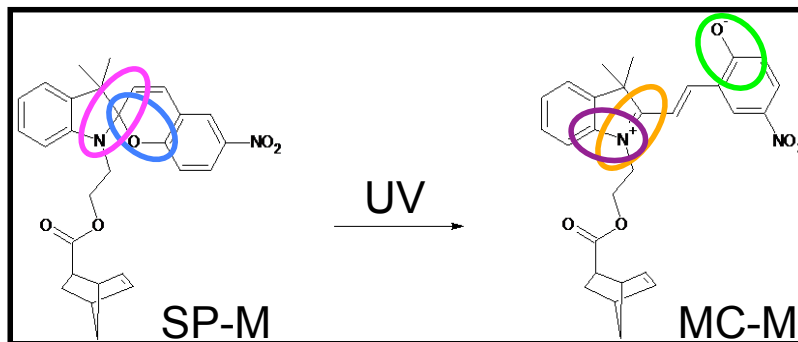
Background

SP-monomer

SP-polymer
Brushes

Solvent
Sensing

Conclusions



Outline

Background

SP-monomer

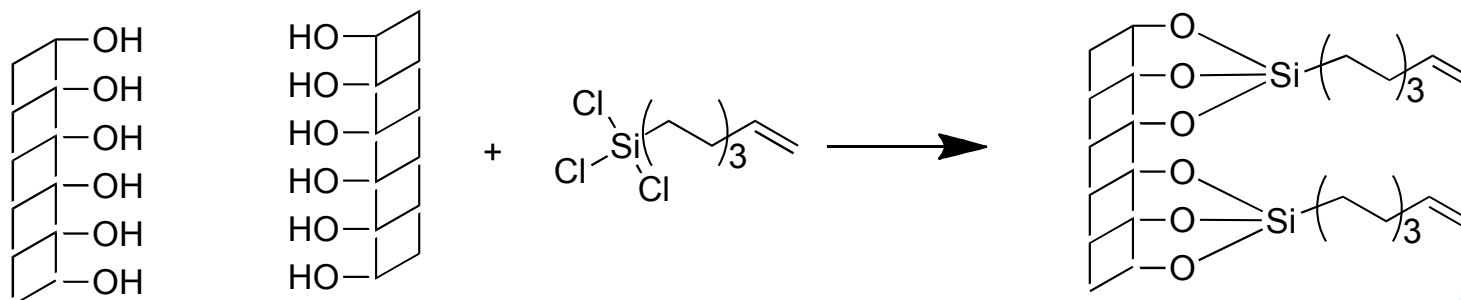
SP-polymer
Brushes

Solvent
Sensing

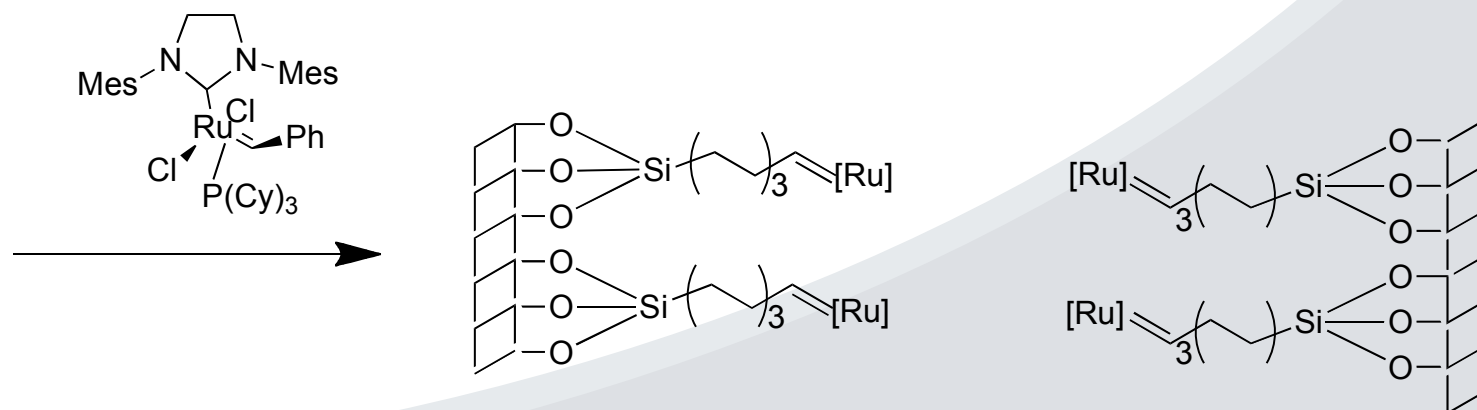
Conclusions

Spiropyran polymeric brushes in micro-capillaries

Silanisation



Attachment of the catalyst



Outline

Background

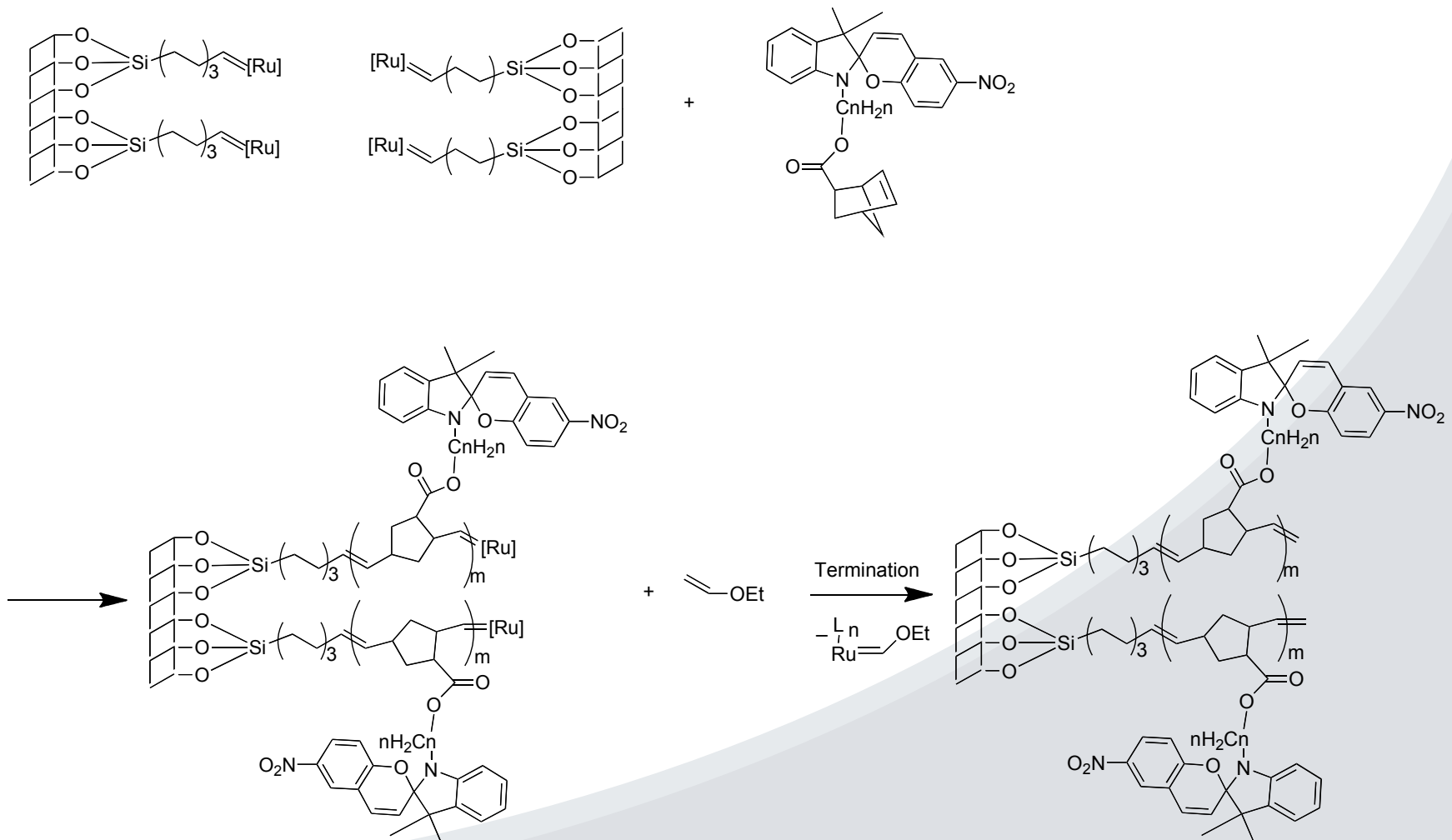
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SP-polymer
Brushes

Solvent
Sensing

Conclusions

Spiropyran polymeric brushes in micro-capillaries



Outline

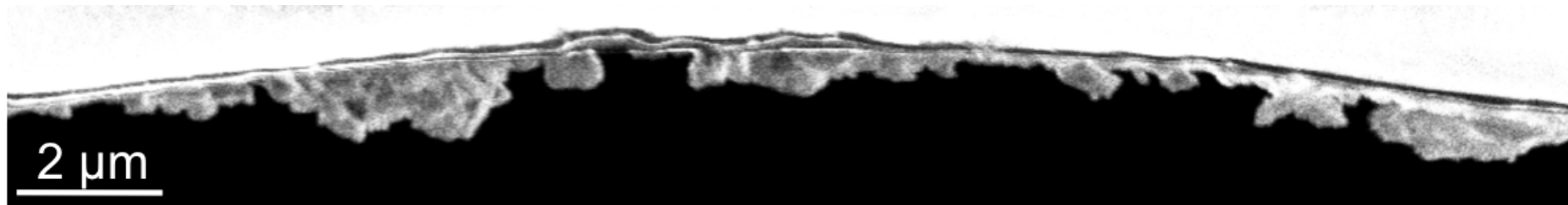
Background

SP-monomer

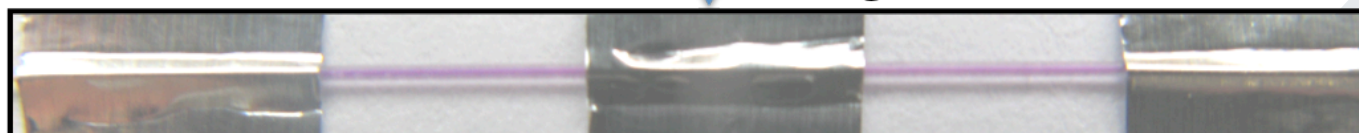
SP-polymer
Brushes

Solvent
Sensing

Conclusions



↓ UV light



↓ Remove mask



↓ White light



Outline

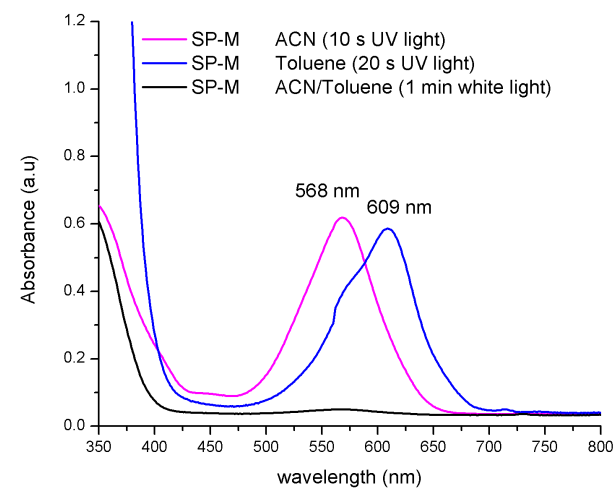
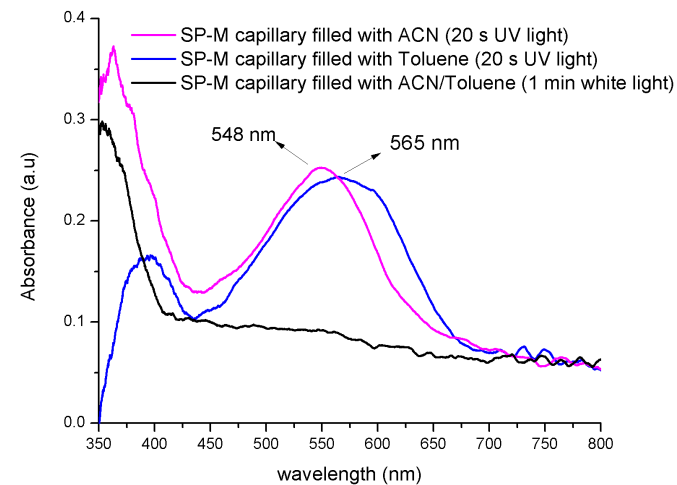
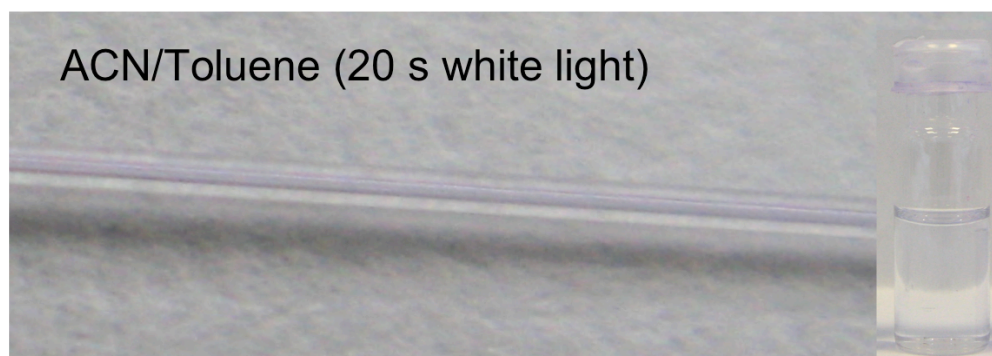
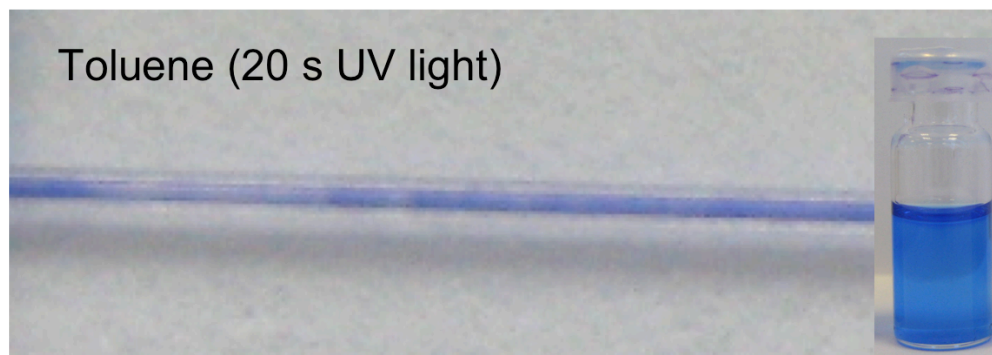
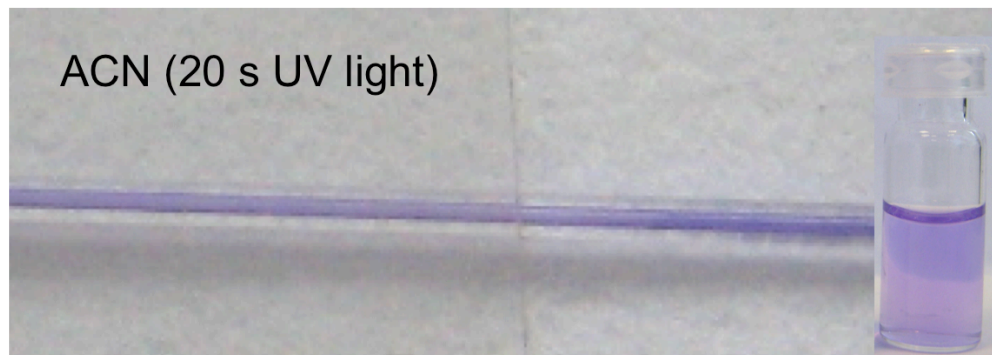
Background

SP-monomer

SP-polymer
Brushes

Solvent
Sensing

Conclusions



Outline

Background

SP-monomer

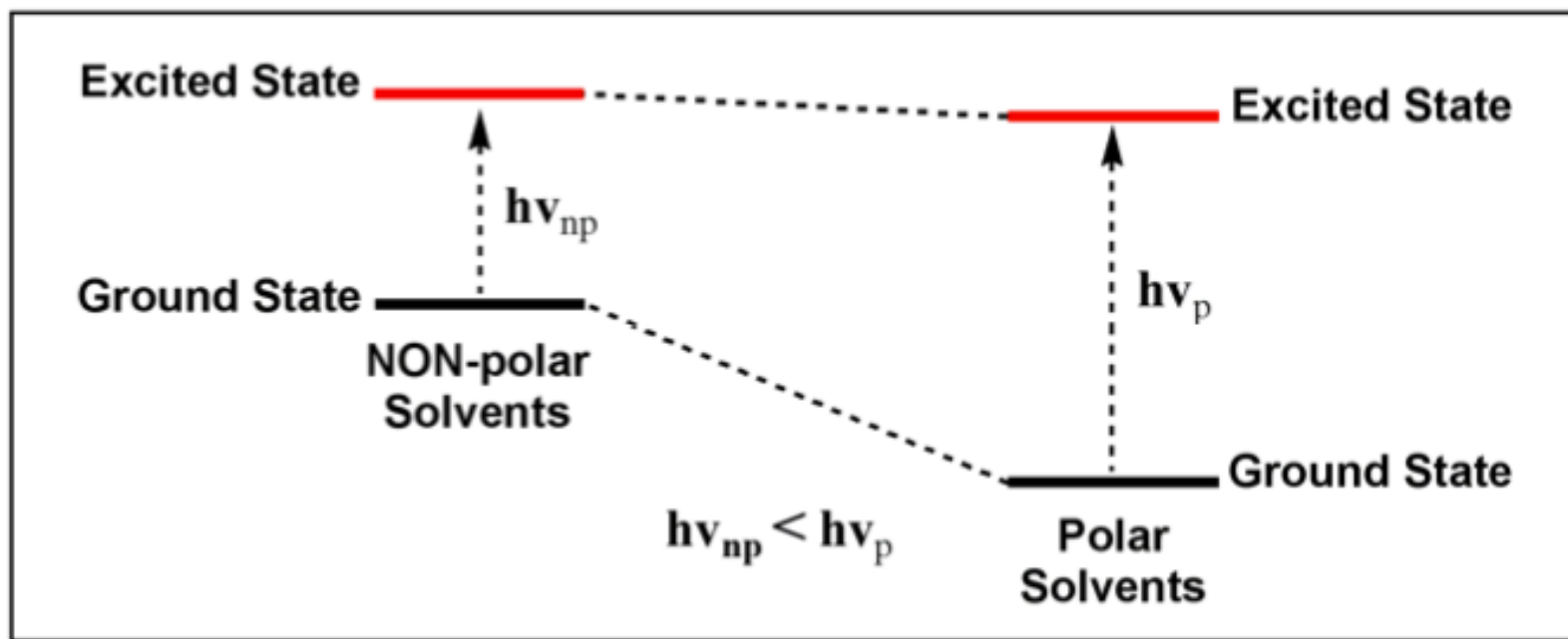
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Sensing

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Solvatochromic Properties

The colour of the MC form depends on the difference in polarity between the photo-excited MC form and the conjugated zwitterionic ground state [1]



- The absorption band of MC form undergoes a hypsochromic (blue) shift in solvents of increasing polarity (negatively solvatochromism).

[1] U.I. Minkin / Chem. Reviews, 104 (2004) 2751-2776.

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Conclusions

- First example of spiropyran polymer brushes in micro-capillaries
- Self-diagnostic for continuous flow device
- Solvent detection in micro-capillaries
- Sensing behaviour can be switched on/off remotely using light

Outline

Background

SP-monomer

SP-polymer
Brushes

Solvent
Sensing

Conclusions

Acknowledgments

- Dr. Fernando Benito-Lopez
- Alexandre Hennart
University of Namur, Belgium
- Dr. Kevin Fraser
- Prof. Dermot Diamond
- IRCSET – Embark Initiative



Thank you for your attention !!





Questions ?