



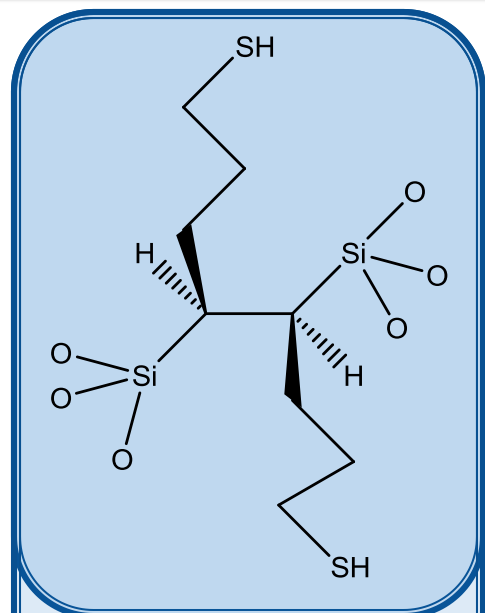
# New Mesoporous Ultrastable Adsorbent for the Removal of Mercury Ions in Water

Drs. Els De Canck  
INANOMAT  
16/04/2010

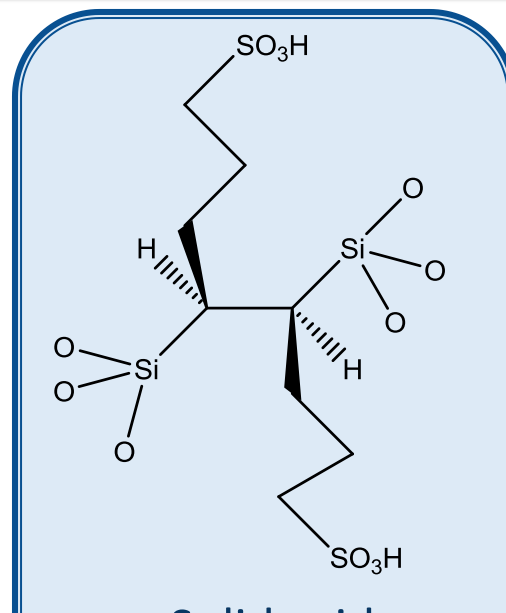
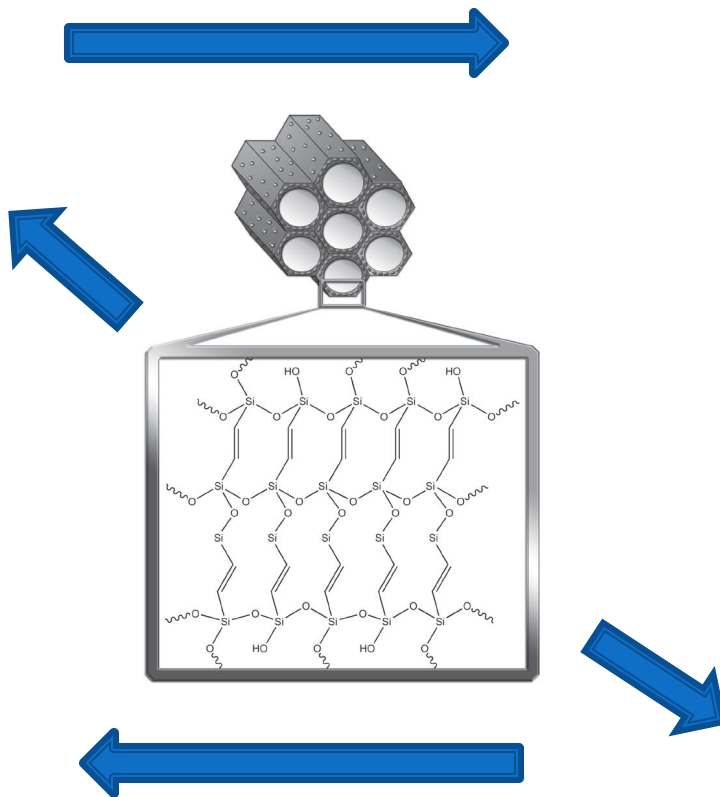
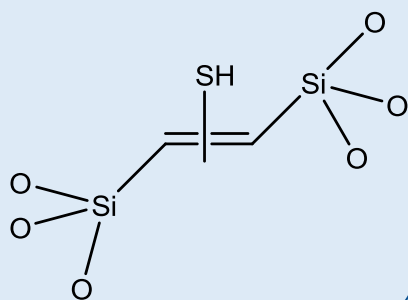
# Outline

- Synthesis of thiol containing Periodic Mesoporous Organosilicas: SH-(CH<sub>2</sub>)<sub>3</sub>-PMO
- Mercury(II) ion adsorption
  - Comparison with other mesoporous silica adsorbents
    - One-pot-synthesis
    - Post-synthetic modification of SBA-15
  - Thiol containing Periodic Mesoporous Organosilica
- Conclusions

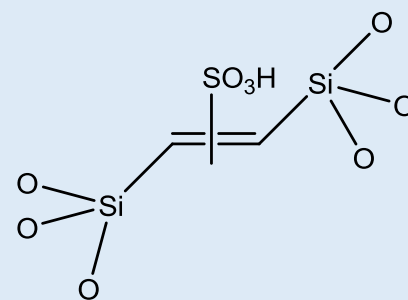
# Thiol containing PMOs



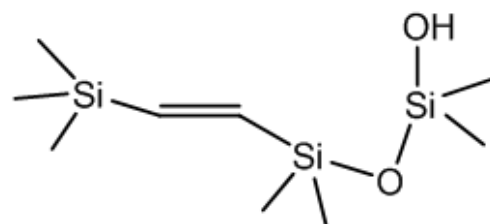
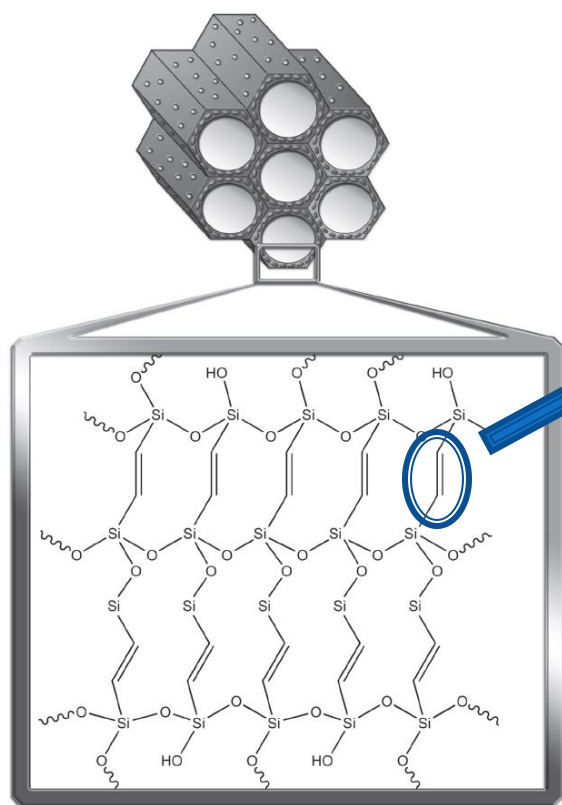
Mercury(II) ion adsorption



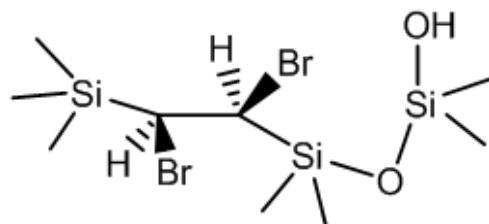
Solid acid catalysis



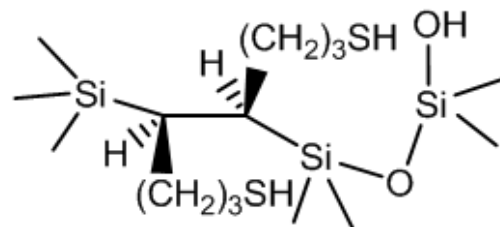
# Thiol containing PMOs - Synthesis



**Bromination with Br<sub>2</sub> (g)**



**Substitution with Cl-Mg-(CH<sub>2</sub>)<sub>3</sub>-SH**



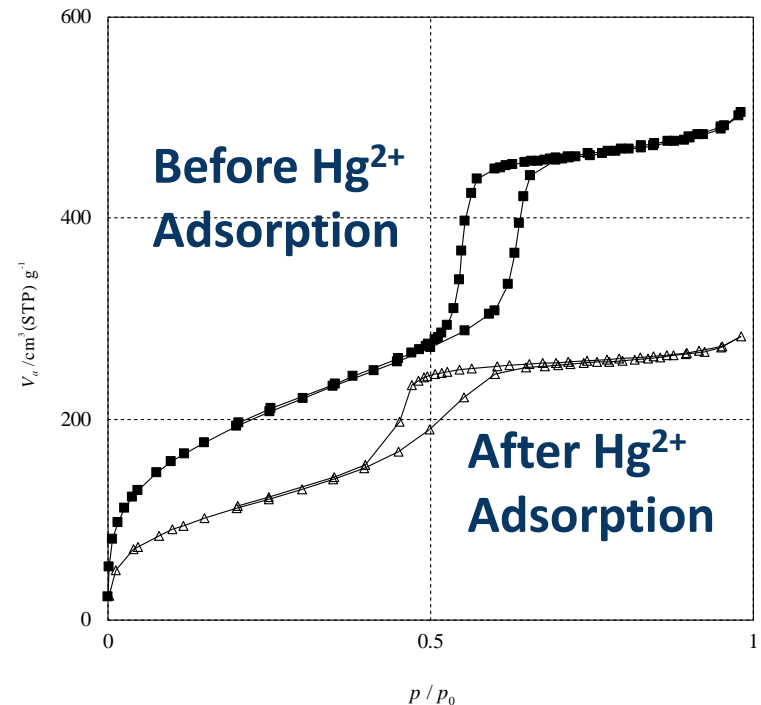
De Canck E. et al., *Langmuir*, 2010  
DOI: 10.1021/la100204d

# Mercury(II) ion adsorption

- Other mesoporous silica adsorbents
  - One-pot-synthesis with  $-(\text{CH}_2)_3\text{-SH}$  functionalities

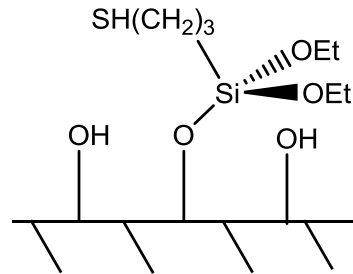
- Using this material as an adsorbent results into:
  - Complete loss of mesoporous structure

=> Hydrolysis of Si-O-Si bond



# Mercury(II) ion adsorption

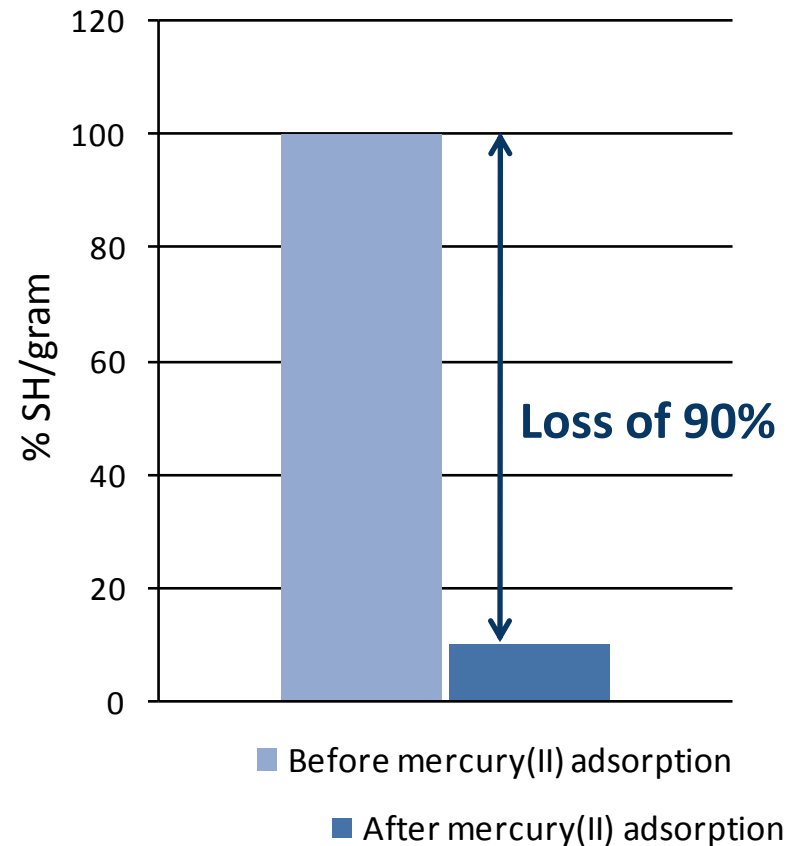
- Other mesoporous silica adsorbents
  - SBA-15 functionalized with  $-(\text{CH}_2)_3\text{-SH}$  (post-synthesis)



- Using this material as an adsorbent results into:

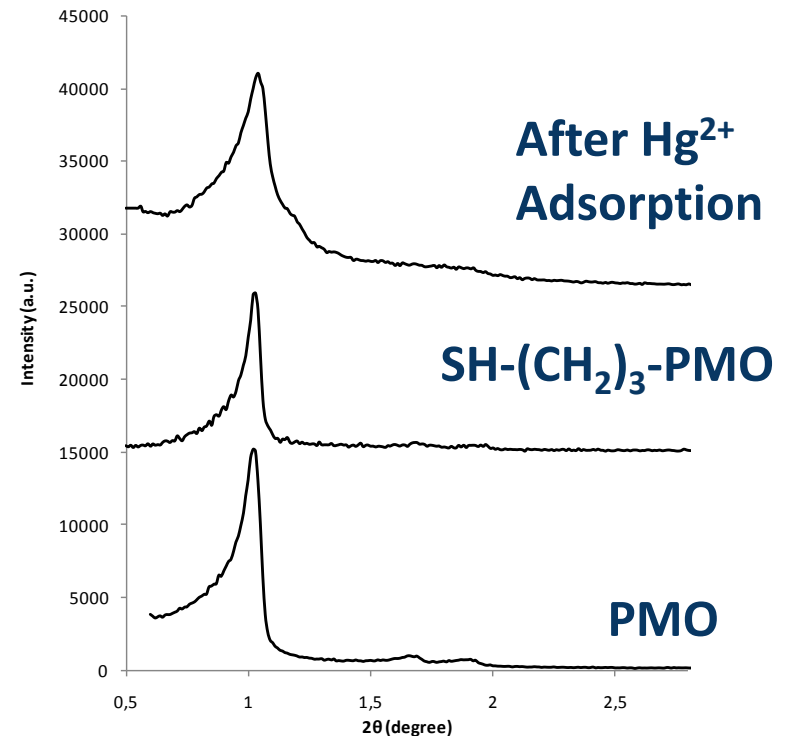
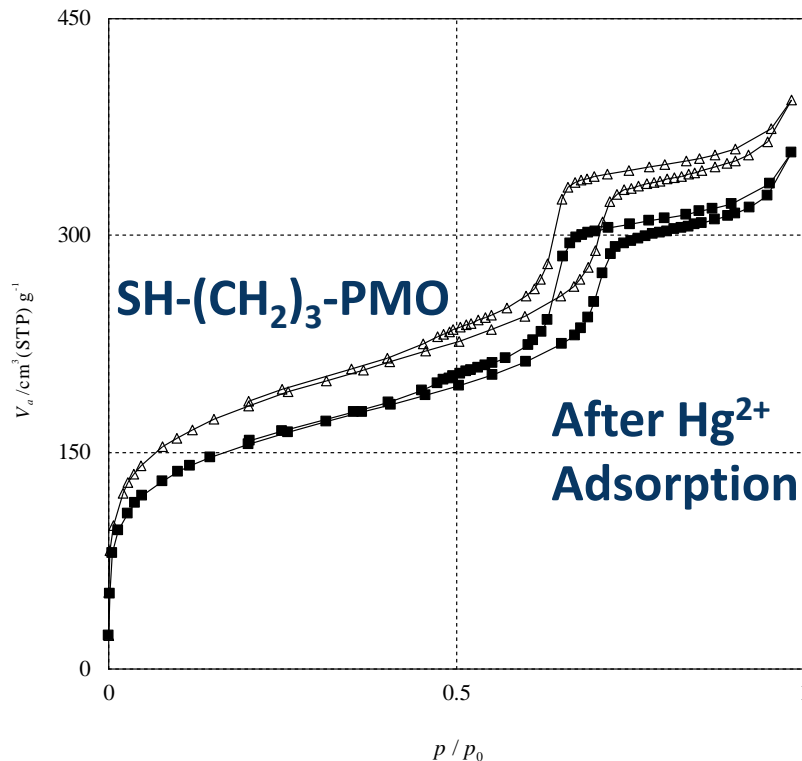
- Loss of thiol functionalities

=> Hydrolysis of Si-O-Si bond



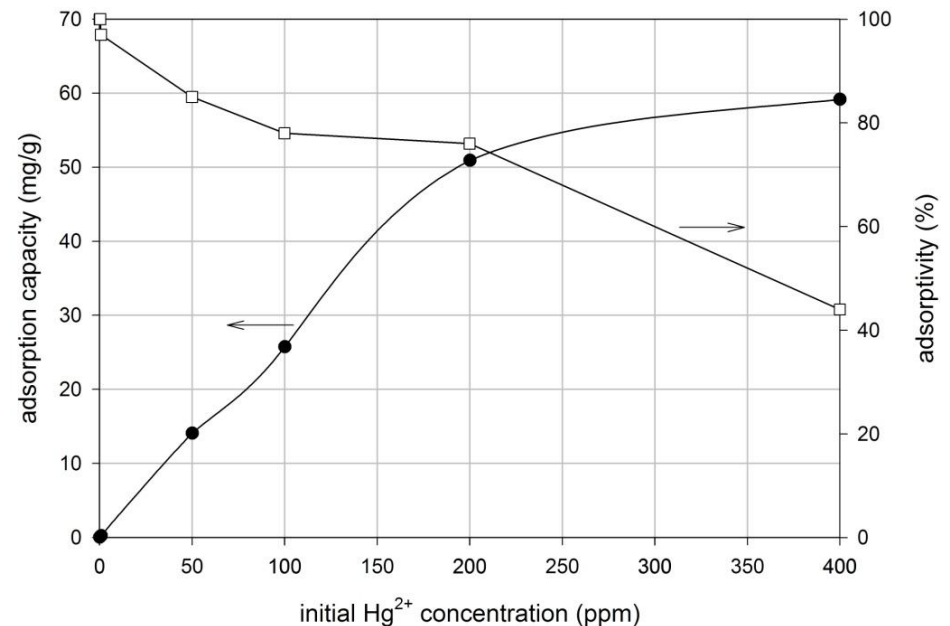
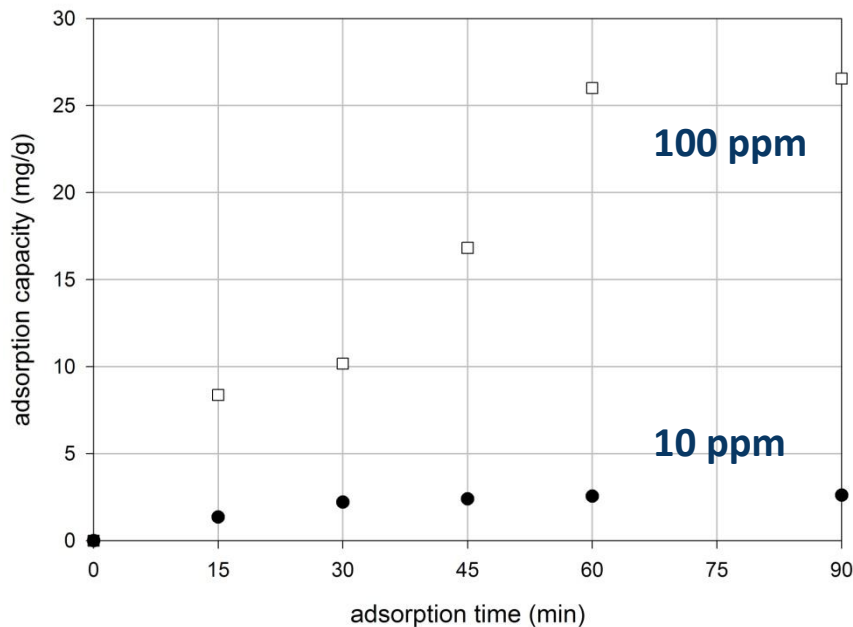
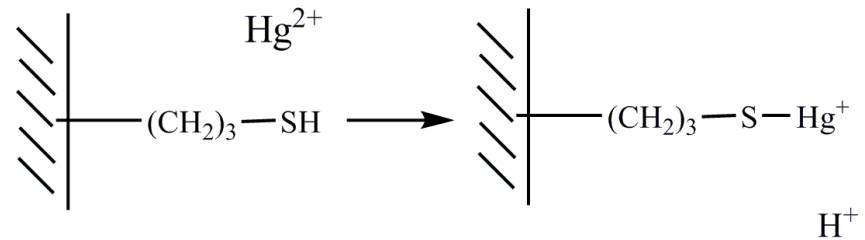
# Mercury(II) ion adsorption

- Structural stability: XRD and nitrogen adsorption measurement
- Chemical stability: No loss of thiol groups  
=> Stable C-C bond



# Mercury(II) ion adsorption

- Experiments show a 1:1 ratio  $\text{Hg}^{2+}/\text{SH}$



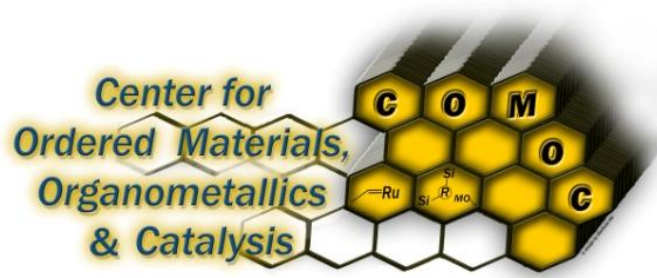


# Conclusions

- Successful and reproducible synthesis of new thiol containing PMO material
- Adsorption of mercury(II) ion
  - No loss of mesoporous structure after mercury(II) adsorption
  - No loss of thiol functionalities
  - 1:1 ratio  $\text{Hg}^{2+}/\text{SH}$

# Acknowledgement

- COMOC



- University Ghent



- Hogeschool Ghent





Center for  
Ordered Materials,  
Organometallics  
& Catalysis



**Thank you for your attention!**