



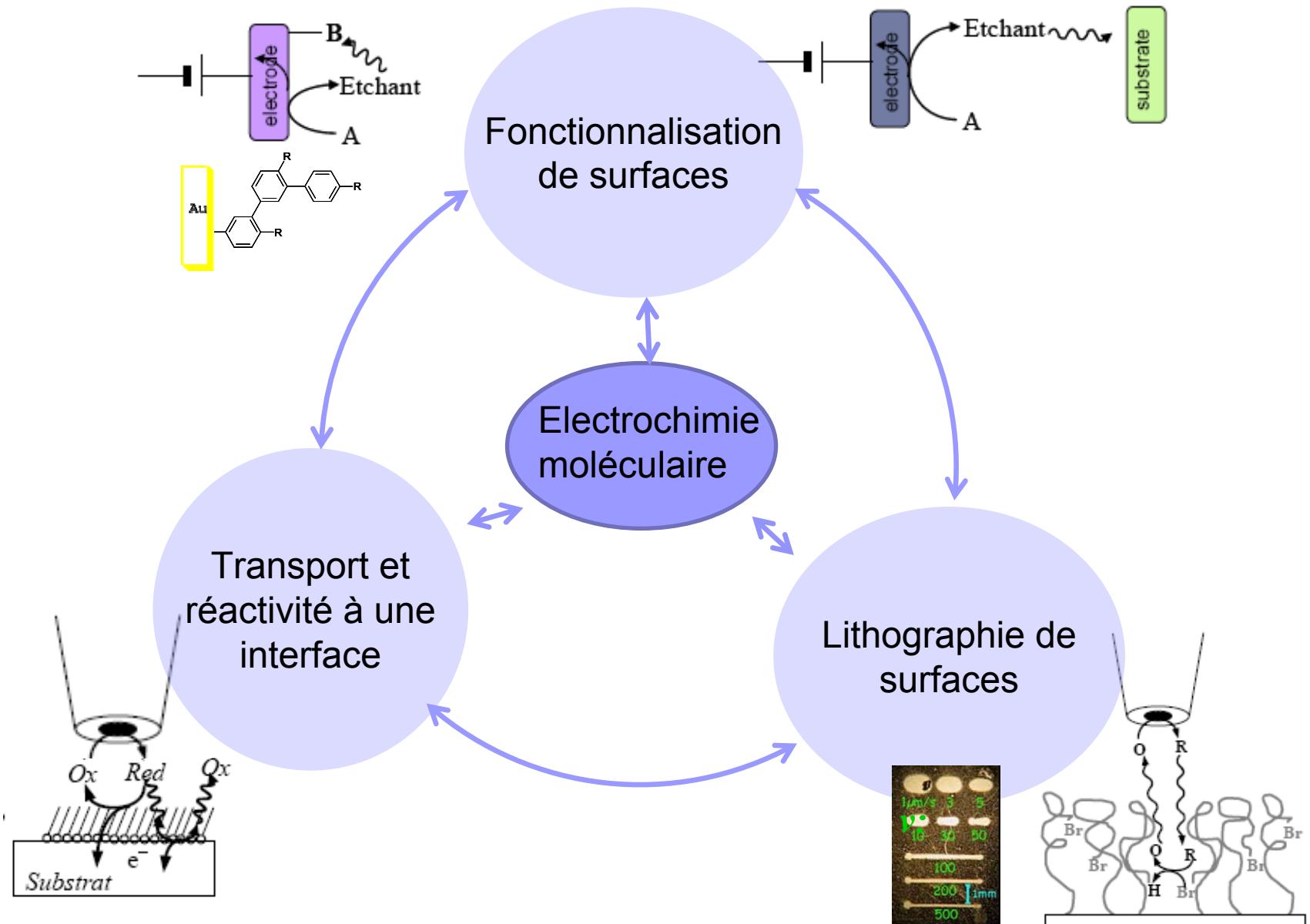
R activit  et  lectrogreffage localis s de surfaces

Fr d ric Kanoufi

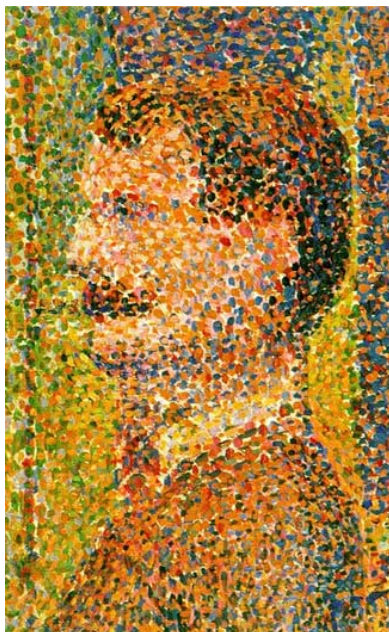
Activation  lectrochimique - LSABM, PECSA - CNRS UMR 7195
ESPCI ParisTech



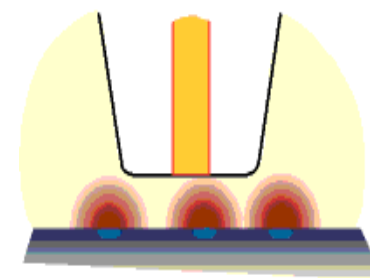
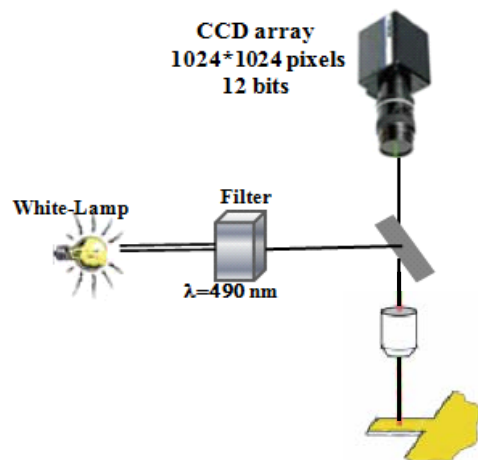
Réactivité et électrogreffage localisés de surfaces



Accéder à la réactivité chimique locale



VS

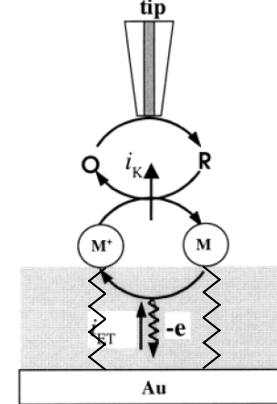
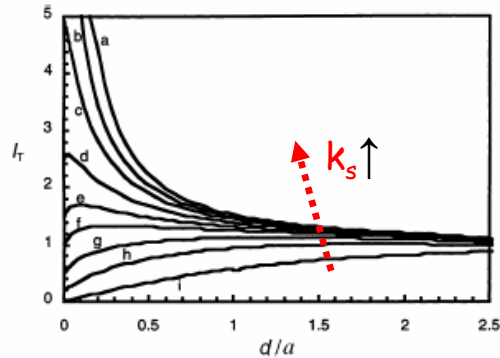
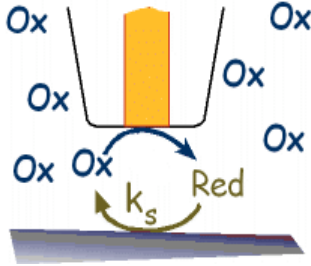


F. Kanoufi, H.S. White, Imaging Molecular Transport across Membranes, In *Scanning Electrochemical Microscopy*, Bard & Mirkin, 2nd Ed, May 2012.

Réactivité de surface et microscopie électrochimique



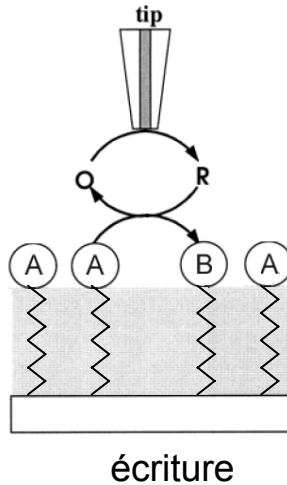
➤ La procédure standard – cinétique et courbes d'approche $I_T = f(d/a)$



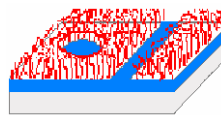
rédox réversible



➤ Notre approche: Réactivité locale par écriture/lecture



transformation irréversible
 $A \rightarrow B$



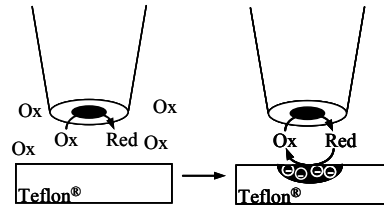
lecture

• Cinétique de croissance de motifs \Rightarrow réactivité de surface

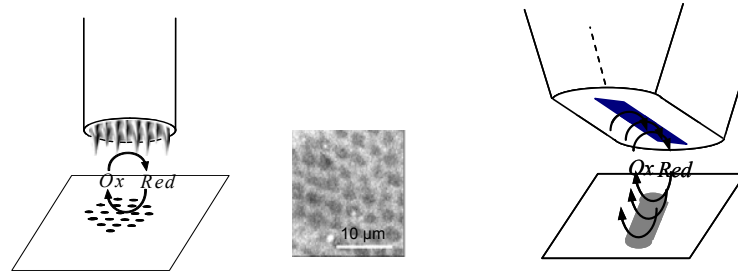
Lithographie électrochimique par SECM



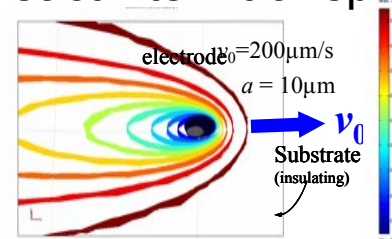
■ Réactifs/substrats



■ Patterning; stratégies



■ Modélisation mésoscopique processus de réactivité – transport



■ Caractérisation des Motifs: spectroscopies, imagerie, mouillage, amplification chimique...

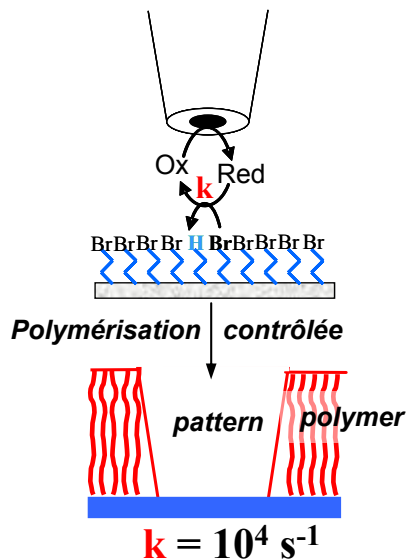
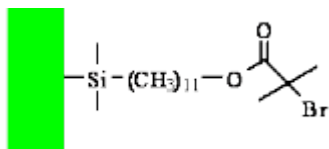


Exemple: amplification chimique

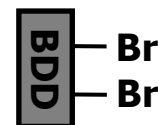


Monocouches

Silanes

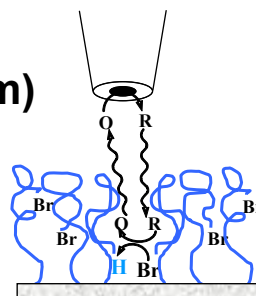
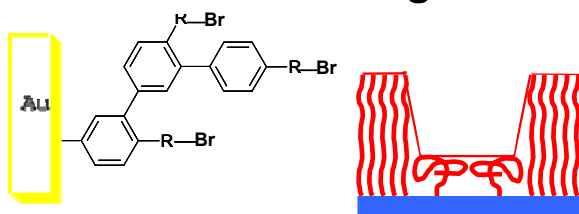


BDD-Br : Diamond dopé Bore bromé

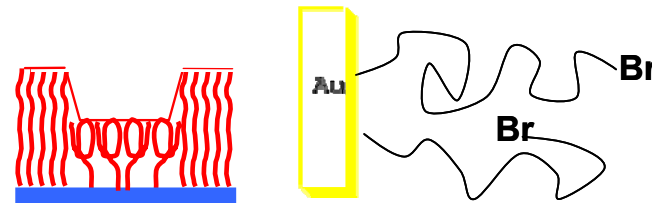


Multicouches

Couches électrogressées (4-6 nm)



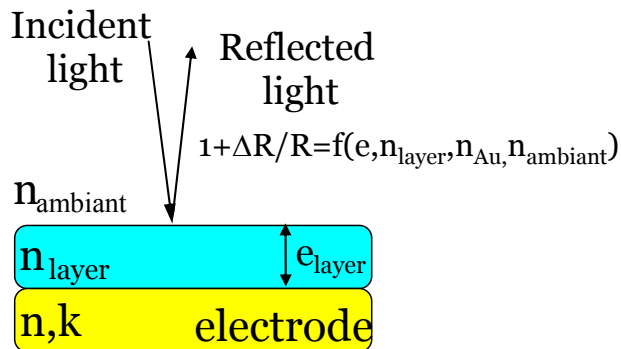
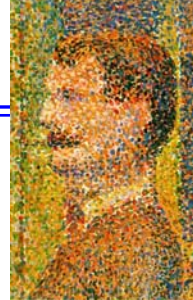
Macromolécules (brosses > 20 nm)



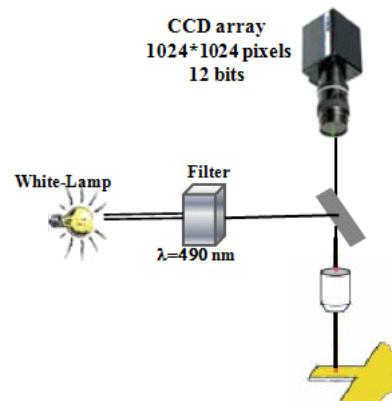
Accessibilité et perméation:

Si-O-R-Br ~ BDD-Br > Au -Ph-R-Br > Macro-initiateur

"Miroir, mon beau miroir, dis-moi..."

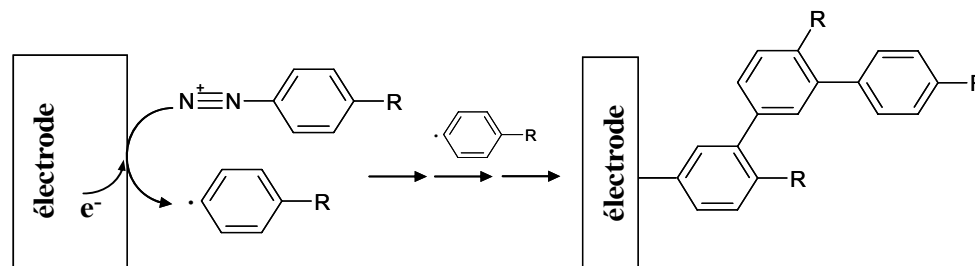


principe



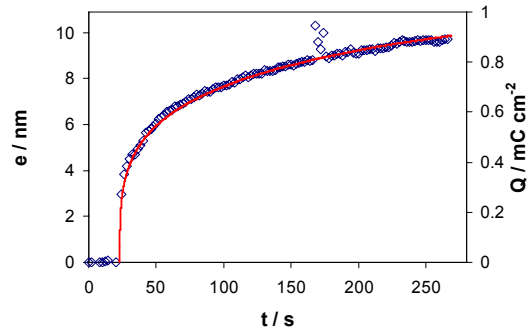
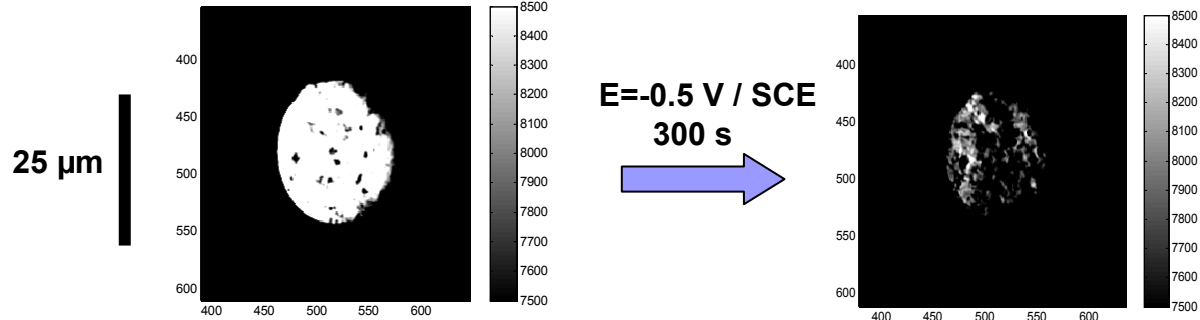
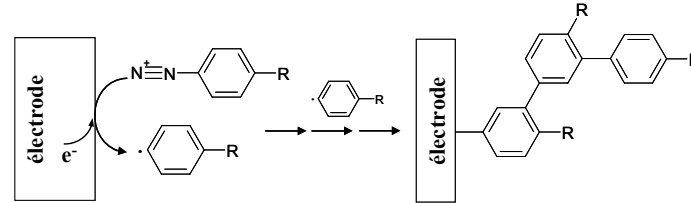
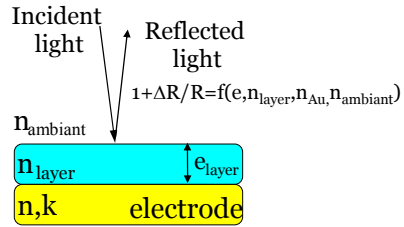
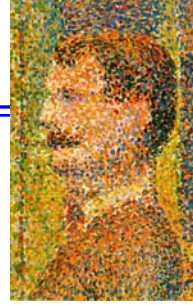
dispositif

Imager in-situ et en temps réel la réactivité chimique



modèle

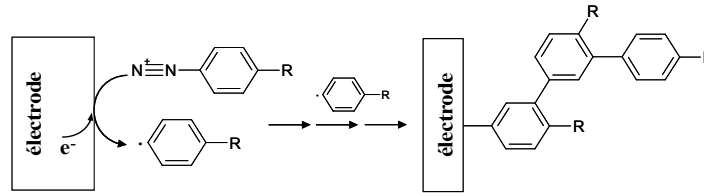
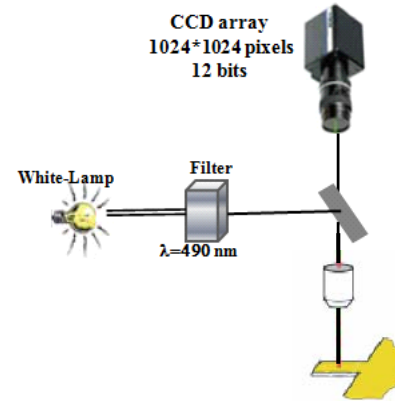
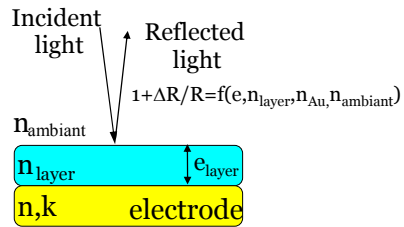
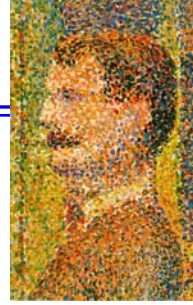
réactivité électrochimique locale



Cinétique in situ

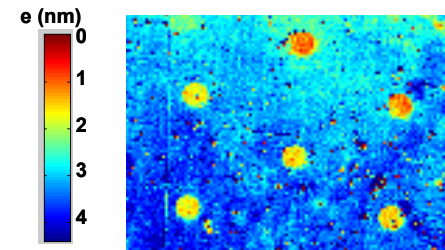
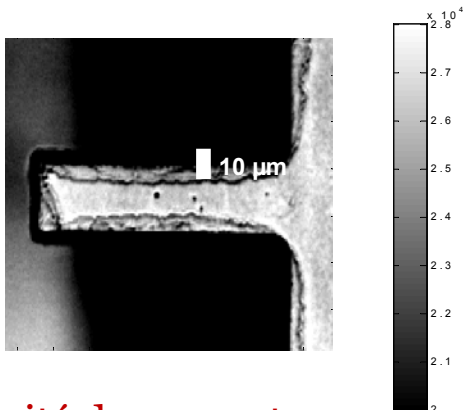
Sensibilité $< 1 \text{ ng/cm}^2$ comparable à QCM, SPR
résolution $< 1 \mu\text{m}$, toute électrode

réactivité chimique locale

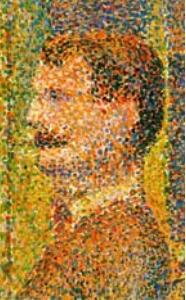


Réactivité locale électrochimique

Réactivité locale chimique



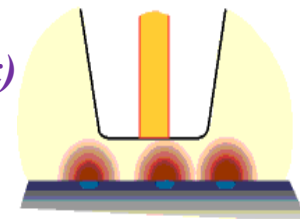
Densité de courant
Effets de bord



C. Combellas
J. Pinson
F. Podvoric
S. Nunige



PhD
D. Mazouzi, A. Fuchs (lithographie, fondamentaux)
C. Slim (brosses polymères)
N.Ktari (lithographie)
S. Munteanu (imagerie, electrogreffage)
A. Berisha (photogreffage)



Post-docs
H. Hazimeh (moléculaire)
F. Hauquier (ATRP local)
T. Matrab (ATRP local)
Y. Fedala (imagerie optique)

Hydrodynamique *Optique, imagerie*
M. Fermigier *J-P Roger*
D. Beysens *G. Tessier*

PECSA-UPMC
 (nanoparticules)

J.M. Siaugue
J. Fresnais

ATRP, AFM
C. Frétigny
Y. Tran

ESPCI

Catalyseurs
J. Cossy
D. Belotti

N. Pantoustier
B. Bresson

Bioanalytique

P. Poncet *S. Descroix*
H. Sénéchal *B. Teste*
Z. Lenkei

INSTITUT CURIE
 (adhésion cellulaire)

L. Malaquin
M. Piel

MINES (mouillage)
M. Shanahan

IRI, Lille (BDD)
S. Szunerits

ITODYS-UnivP7
 (XPS, ATRP)

M. Delamar
M. Chehimi
C. Conan
C. Mangeney

ENSCP, Bordeaux
 (nanosondes, billes)
F. Deiss
N. Sojic

FEMTO, Besançon
 (microfabrication)
F. Amiot
C. Flammier

Univ. Grenoble
 (modélisation)
C. Lefrou
R. Cornut

AARHUS University
 (SAMs)
K. Torbensen
S. Pedersen
K. Daasbjerg