Testing activity of small clusters to nanometer sized catalysts for methanol synthesis

Mid-Term Review presentation

Filippo Romeggio (ESR 11), DTU Physics

Supervisor: Christian Damsgaard
Co-supervisor: Jakob Kibsgaard

Introduction

Birthday: 18-11-1997

Domodossola, Italy

Introduction

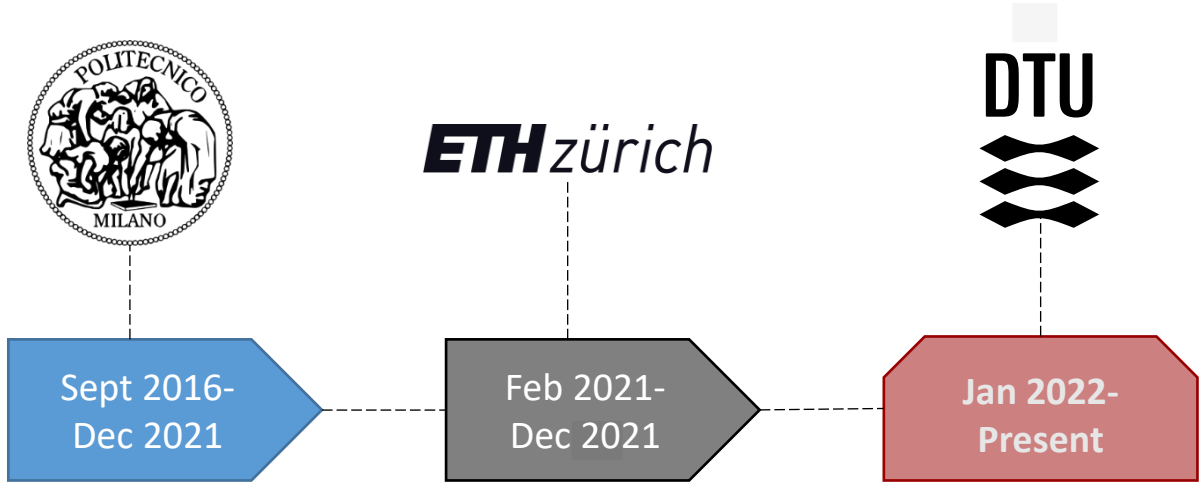
Birthday: 18-11-1997

Domodossola, Italy

Studies

BSc: Chemical engineering

MSc: Chemical process engineering



Role within the CATCHY project

WP1:
Cluster Deposition

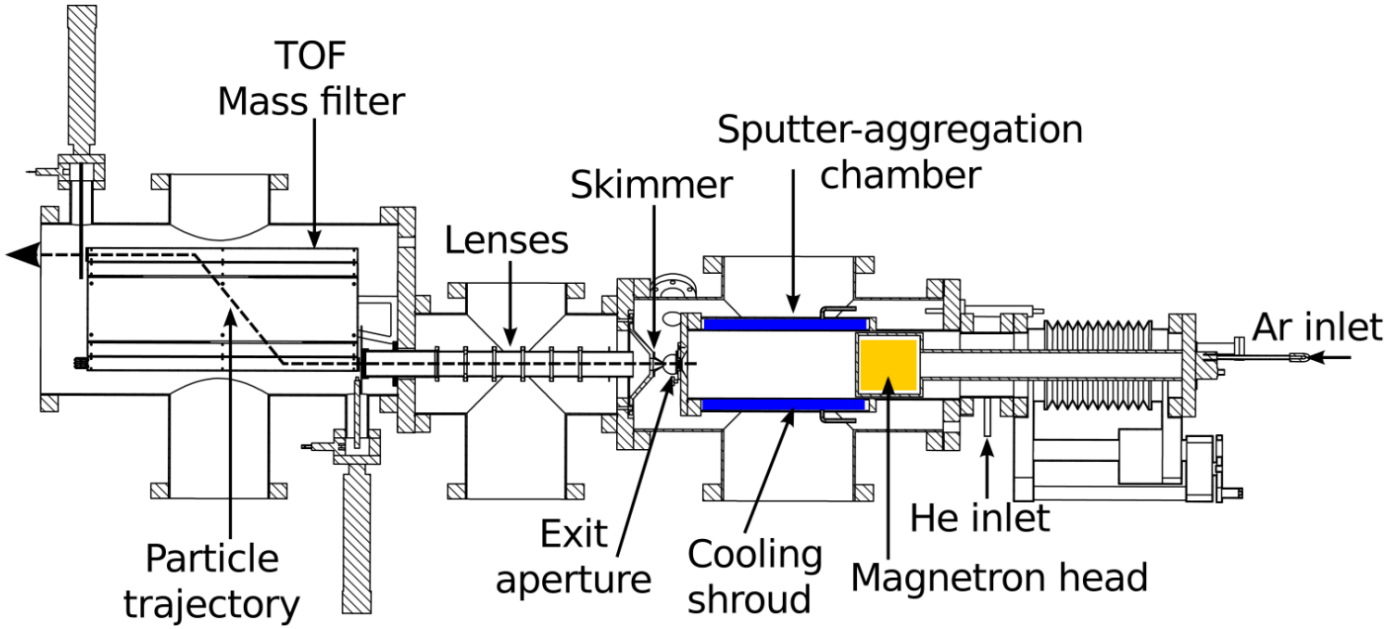
WP2:
Characterization of Deposited Clusters

WP5:
Catalysts Testing and Prototyping

Research progress

WP1:
Cluster Deposition

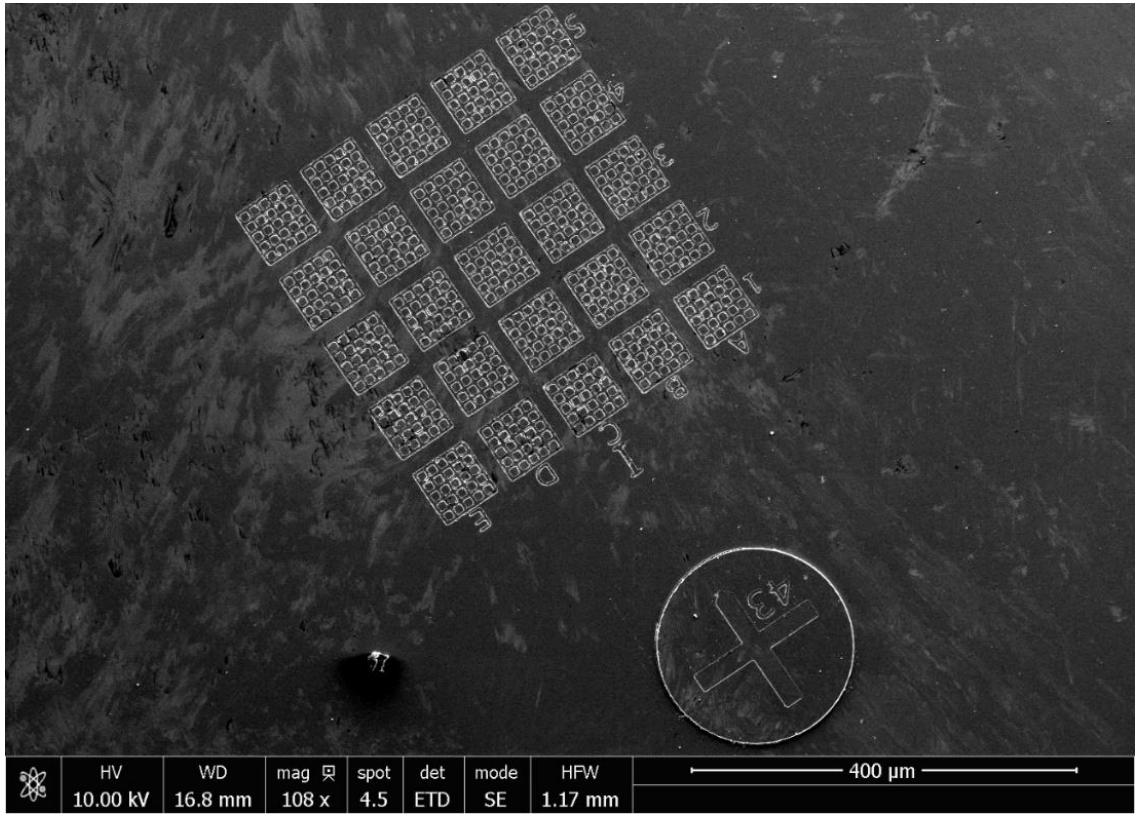
Learned about the deposition system of SurfCat – DTU Physics



Research progress

WP2:
Characterization of Deposited Clusters

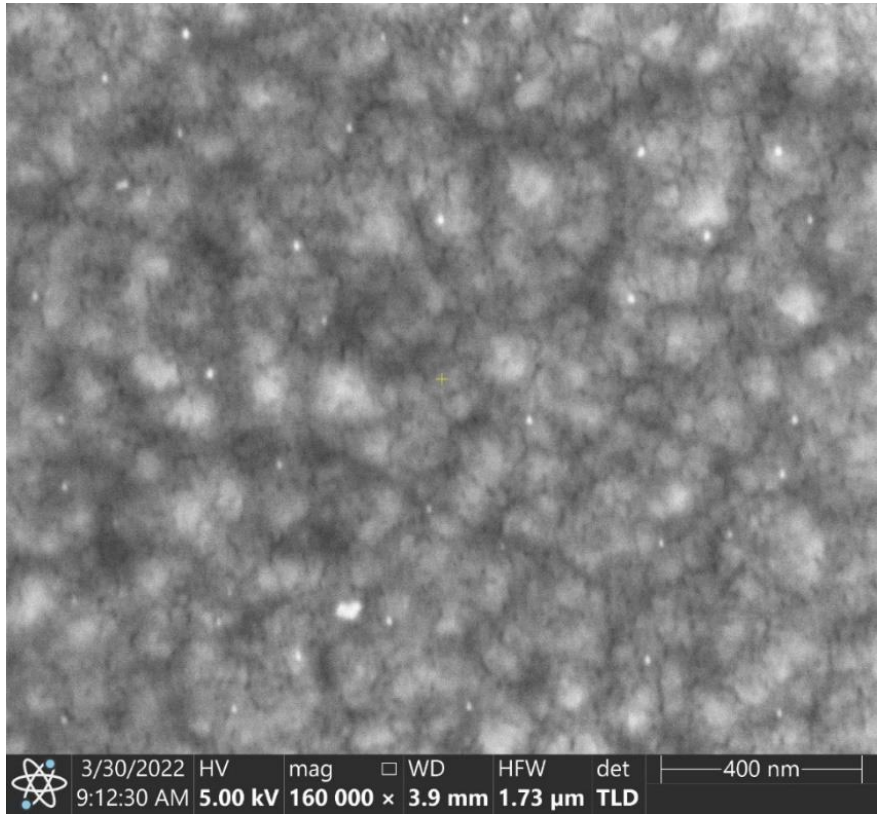
Imaging of nanoparticles on µ-reactors by Scanning Electron Microscopy



Research progress

WP2:
Characterization of Deposited Clusters

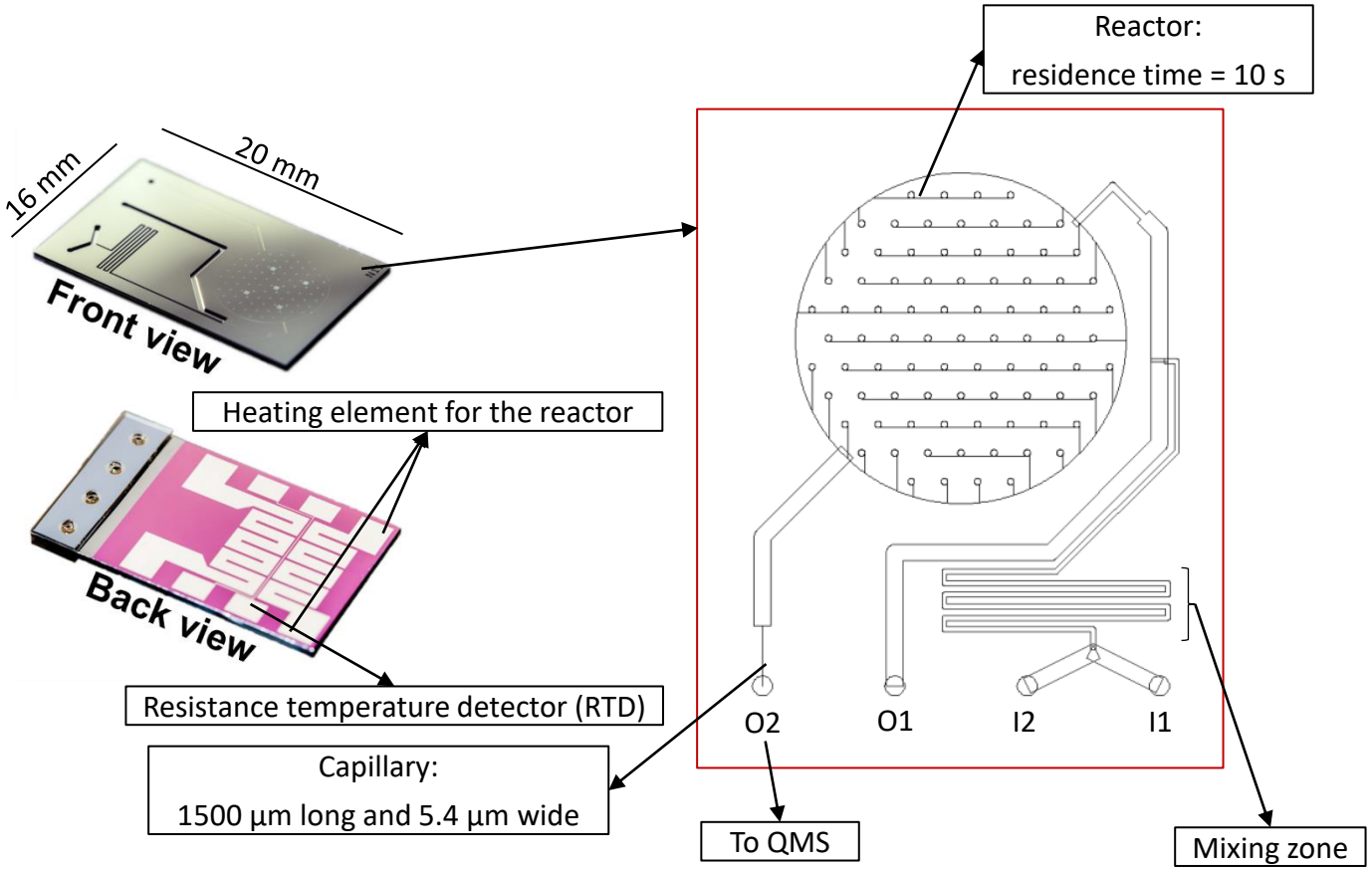
Imaging of nanoparticles on µ-reactors by Scanning Electron Microscopy



Research progress

WP5:
Catalysts Testing and Prototyping

Catalytic testing setup: µ-reactor



Research progress

WP5:
Catalysts Testing and Prototyping

MS and μ-reactor internal and external calibration

$$S_M = F_M^X \times \dot{n}^X$$

$$\dot{n}_{cap}^{O_2} = \frac{S_{M32}}{F_{M32}^{O_2}} \qquad \dot{n}_{cap}^{air} = \frac{\dot{n}_{cap}^{O_2}}{x_{air}^{O_2}}$$

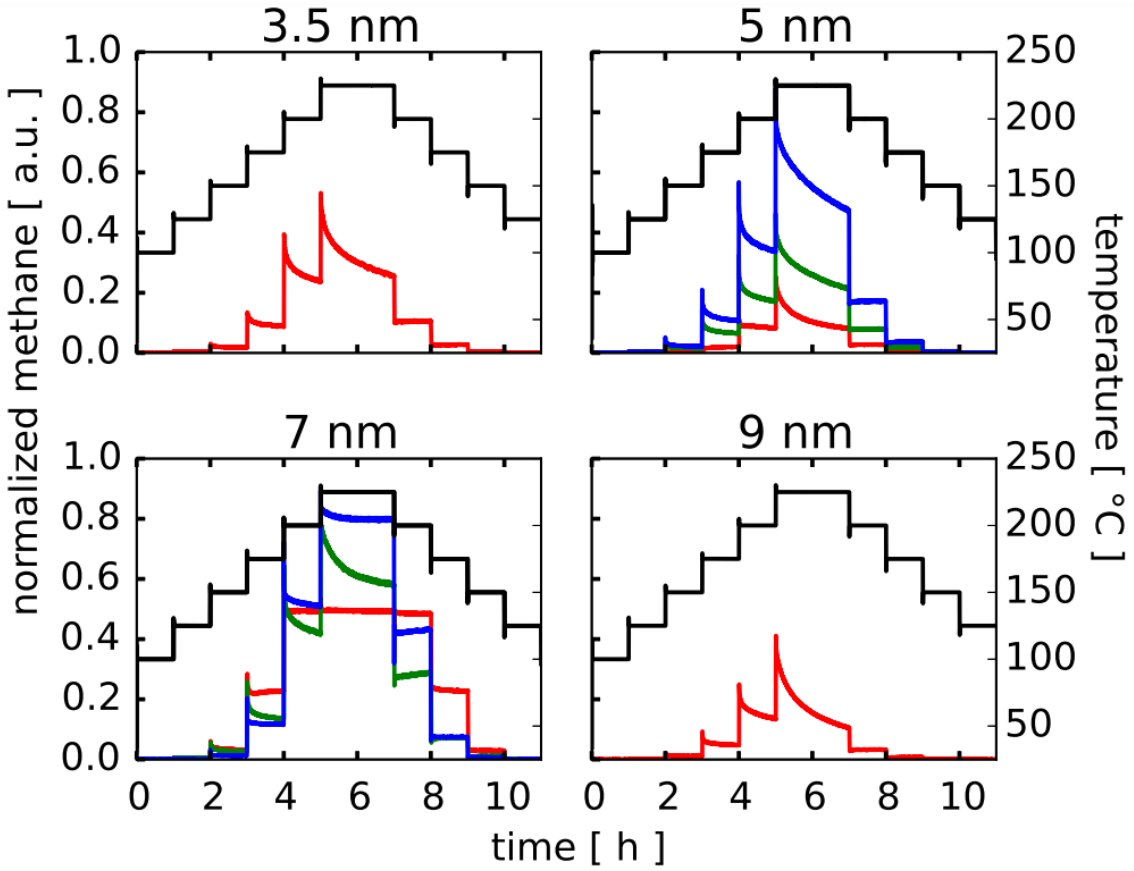
$$\dot{n}_{cap} = \frac{1}{RT}\frac{1}{l_{cap}}\left(\left(\frac{\pi}{8\nu}a^4\bar{p} + \frac{2\pi}{3}a^3\bar{v}\frac{1+2\frac{2\sqrt{2}}{\sqrt{\pi}}\frac{a}{\eta}\frac{\bar{p}}{\bar{v}}}{1+2.48\frac{2\sqrt{2}}{\sqrt{\pi}}\frac{a}{\eta}\frac{\bar{p}}{\bar{v}}}\right)(p_1 - p_{tran}) + \frac{2\pi}{3}a^3\bar{v}(p_{tran} - p_2)\right)$$

$$l_{eff} = \frac{\dot{n}_{cap,nominal}^{air}}{\dot{n}_{cap}^{air}} * l_{cap}$$

Research progress

WP5:
Catalysts Testing and Prototyping

Catalytic activity testing on µ-reactor



Trainings and courses

- **µ-reactor** and **MS** setup for catalytic testing of clusters and nanoparticles
- **SEM** and **EDX** for imaging of the samples
- **Dicing saw** to cut open microreactors after testing

- Surface Physics and Catalysis (10 ECTS)
- Journal Club (5 ECTS)
- Teaching Lab (2,5 ECTS)

Tasks	Work Package	2022									2023
		Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	
Cluster testing	1, 5										→
AFM training	2										
Design of µ-reactor holder for transfer	-										
Gold nanoparticles study by SEM/EDX	2										
Catalytic activity on commercial catalyst	5										
Catalytic activity on Cu based catalysts	5										→
In-situ operando characterization, PSI	2										
SurfCat School (DTU)	-										
Paper writing	-										→

Thank you for your attention!