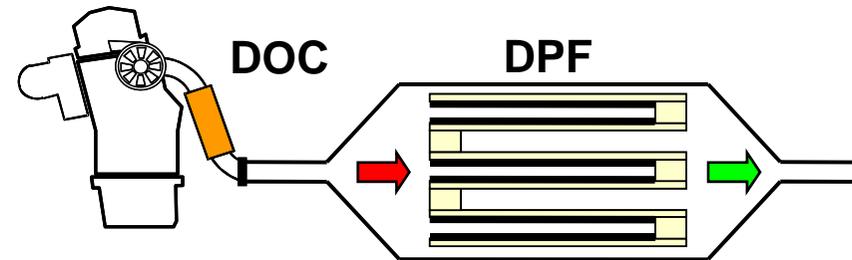
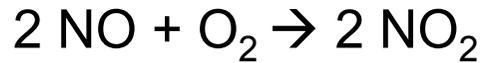


# Soot oxidation on manganese oxide catalysts in diesel and gasoline exhaust gas



Steffen Wagloehner, Maria Nitzer-Noski, Sven Kureti

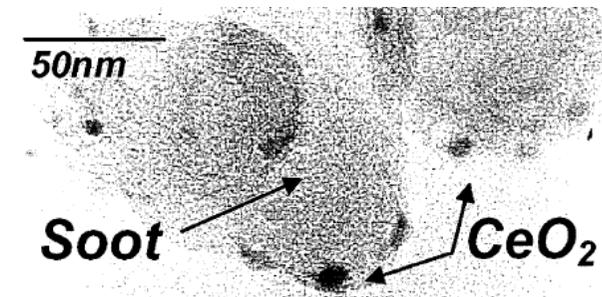
- Passive regeneration ( $T=200\dots450^{\circ}\text{C}$ )



- Active regeneration (fuel post-injection)



- Fuel Borne Catalyst: metal-organic compounds



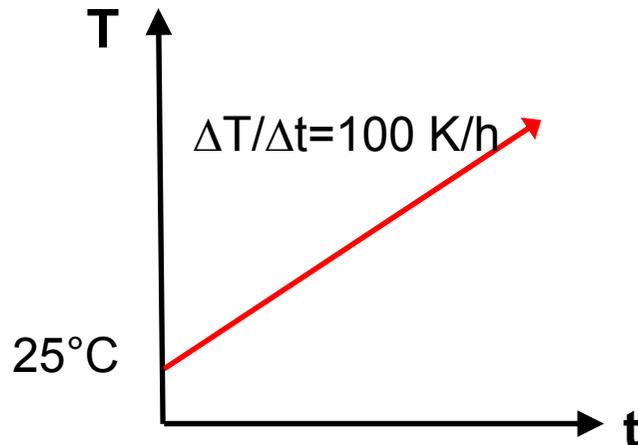
K. Ohno, Ph.D. thesis 2005

- Catalytic DPF (CDPF):  $\text{CeO}_2$  and  $\text{Fe}_2\text{O}_3$  based catalysts



**Evaluation of  $\text{Mn}_x\text{O}_y$  catalysts**

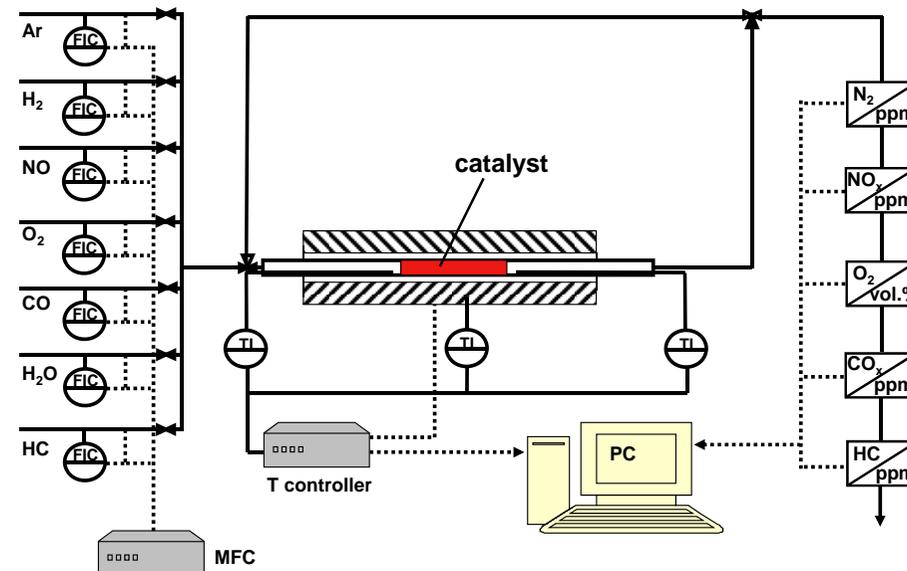
## Temperature Programmed Oxidation (TPO)



Plug flow reactor with packed bed

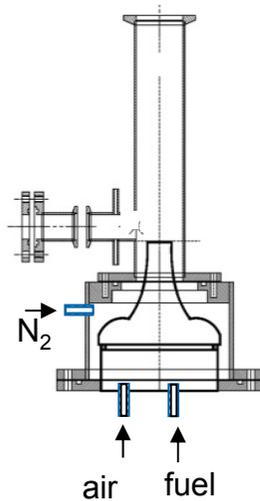
### TPO conditions

- $y(\text{O}_2) = 10\%$ ,  $y(\text{N}_2) = 90\%$
- $F = 500 \text{ mL/min}$
- Intimate catalyst/soot blend
- $\text{C}_3\text{H}_6$ -soot
- $m_{\text{blend}} = 0.9 \text{ g}$  ( $n_{\text{cat}}/n_{\text{soot}} = 2$ )

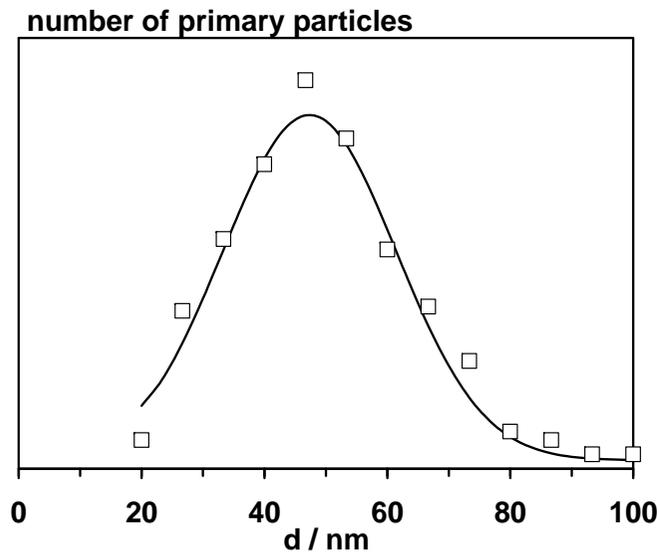
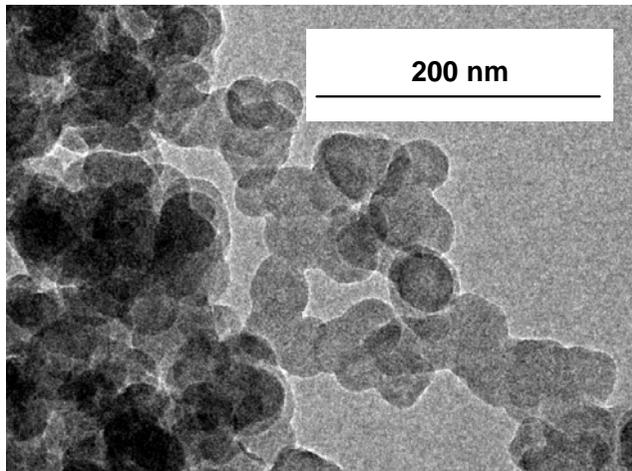


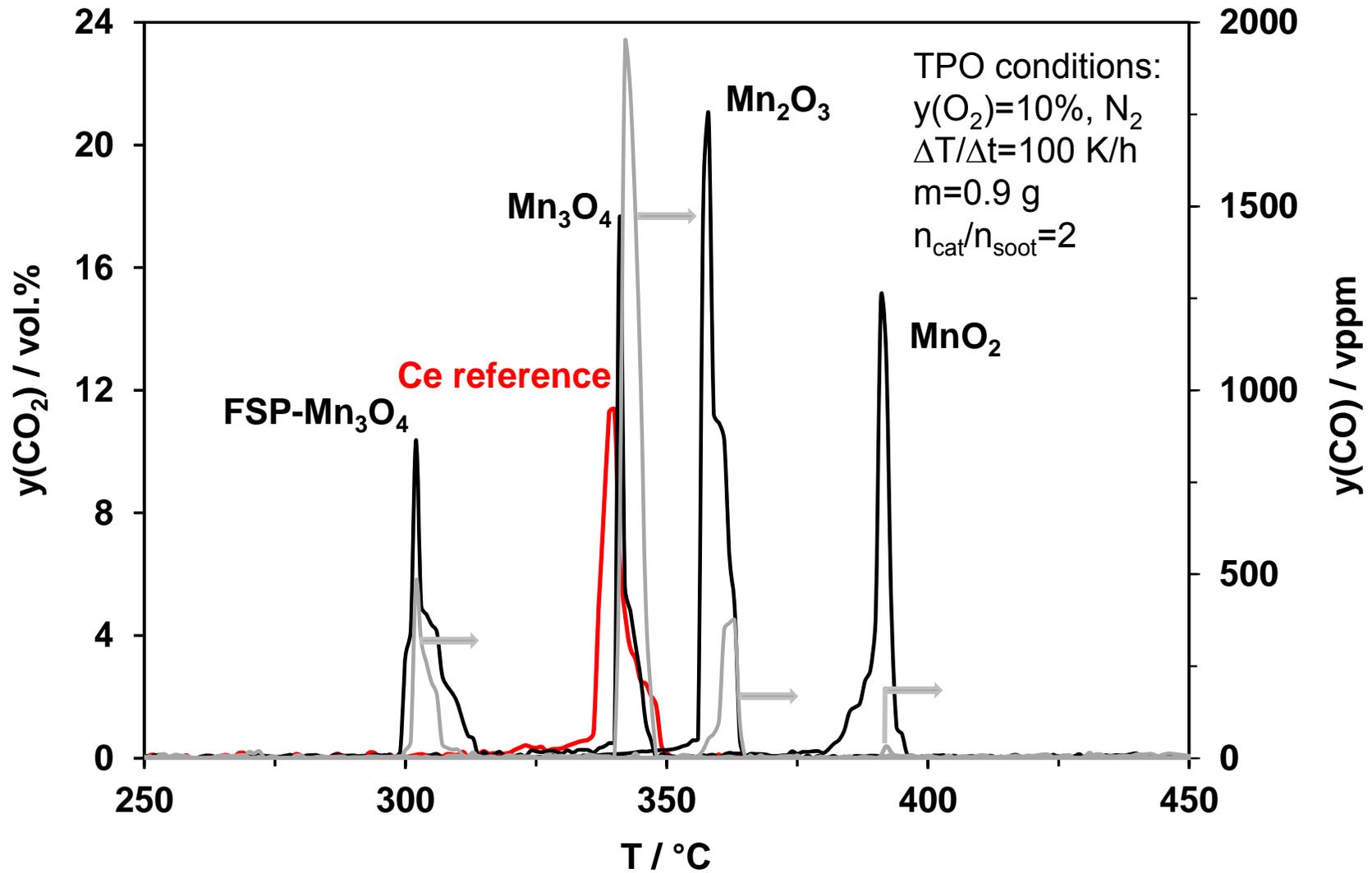
Laboratory test bench

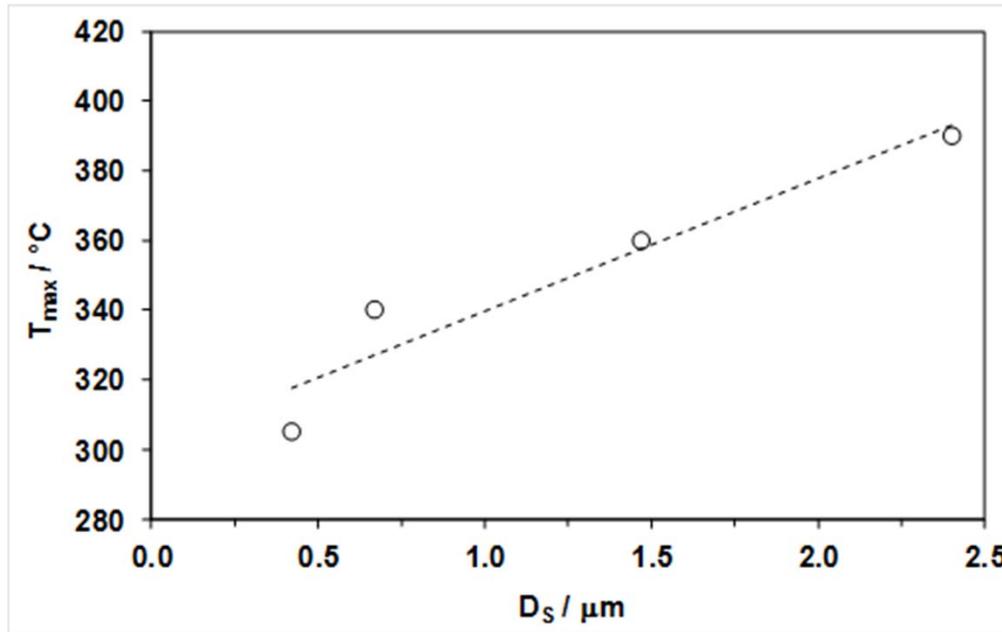
- $C_3H_6/O_2$  diffusion flame



- Adsorbed species: 2.5 wt.%
- Chemical composition
  - 98.8 wt.% C
  - 0.7 wt.% O
  - 0.5 wt.% H
  - <0.1 wt.% N
- $S_{BET} = 65 \text{ m}^2/\text{g}$
- $d = 45 \text{ nm}$  (most frequent diameter)

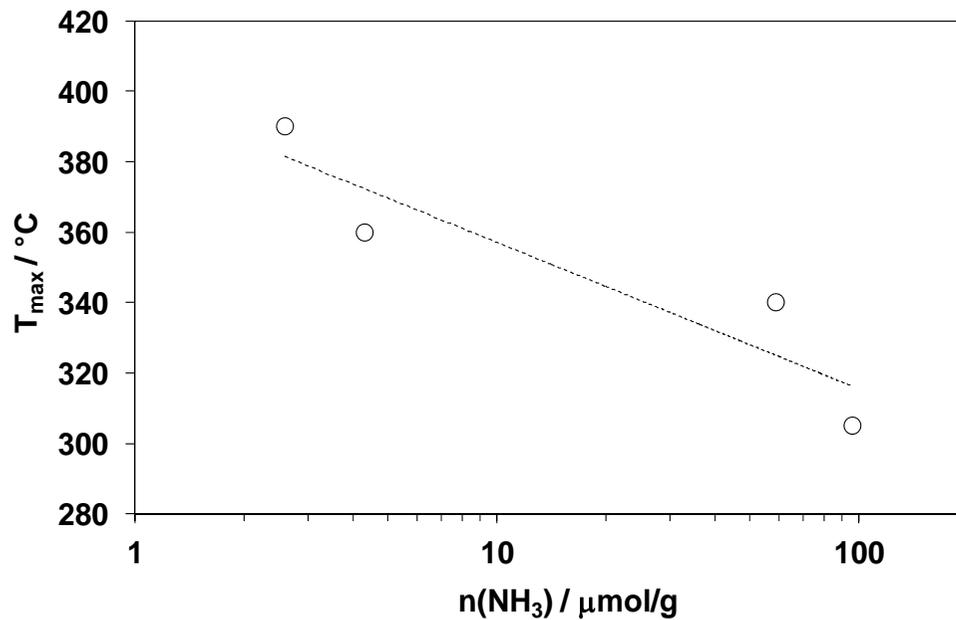
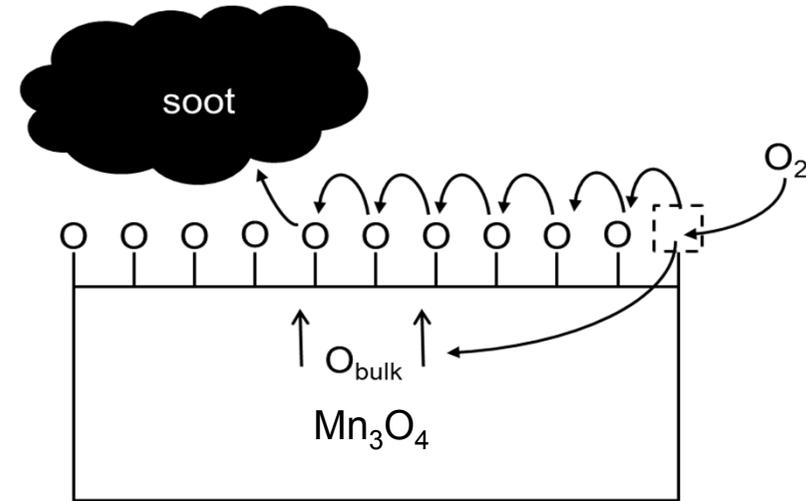






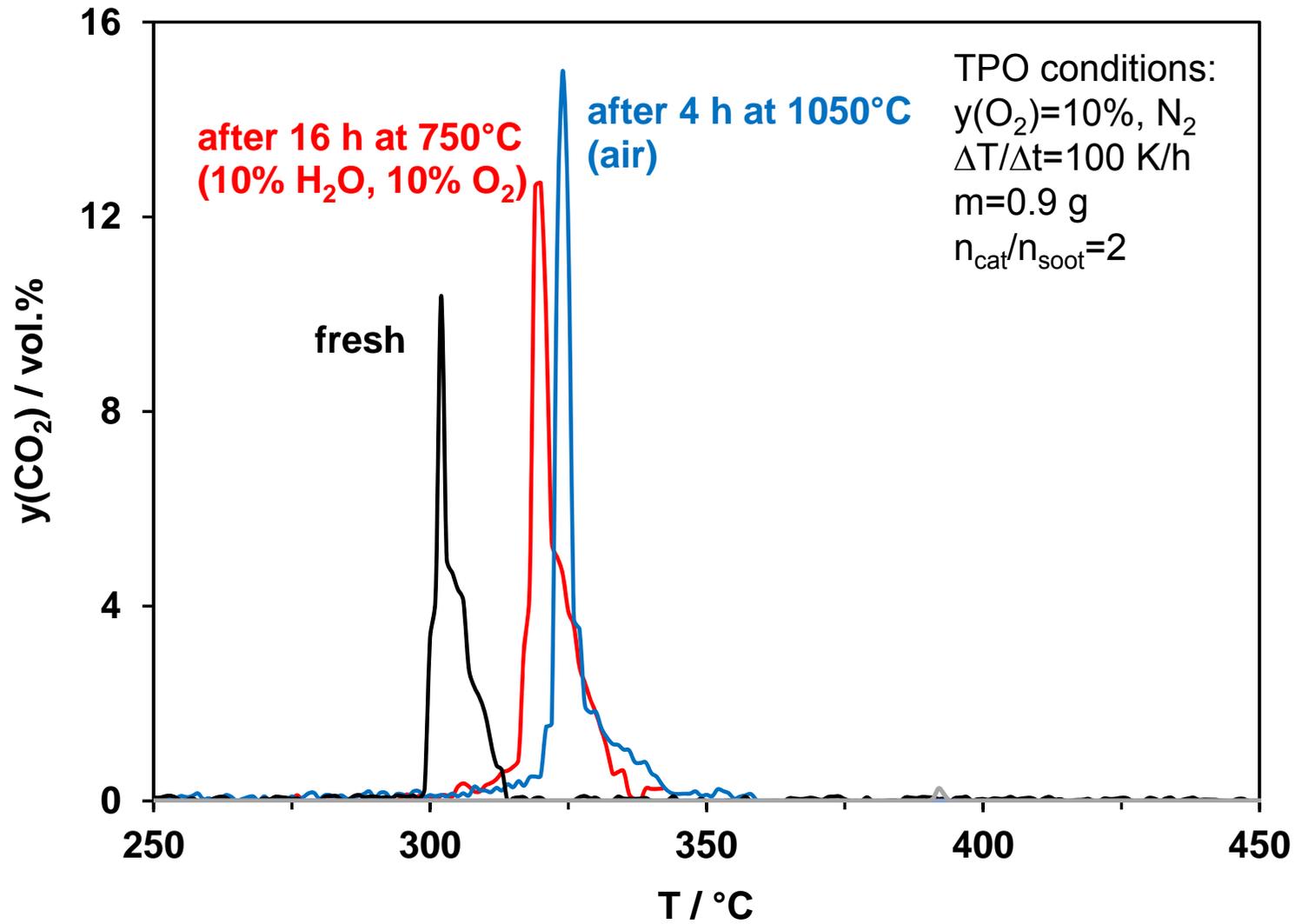
Catalyst size

→ number of contact points

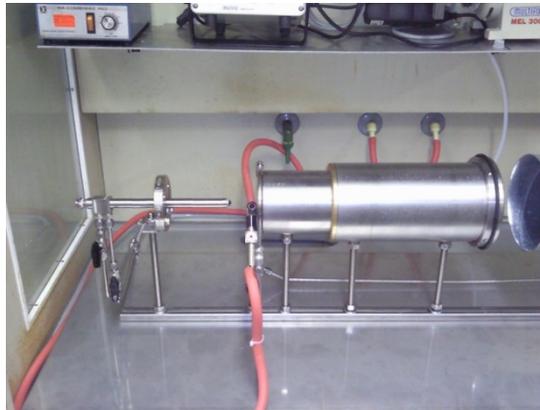


Number of acid sites of catalyst

→ transport of surface oxygen



## Catalytic coating of DPF



FSP bench

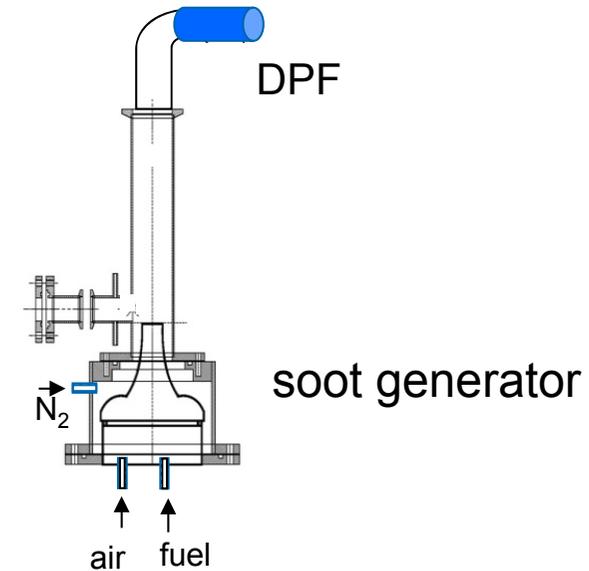


Lab-DPF  
300 cpsi, 1" x 2"  
60% porosity



Coating device

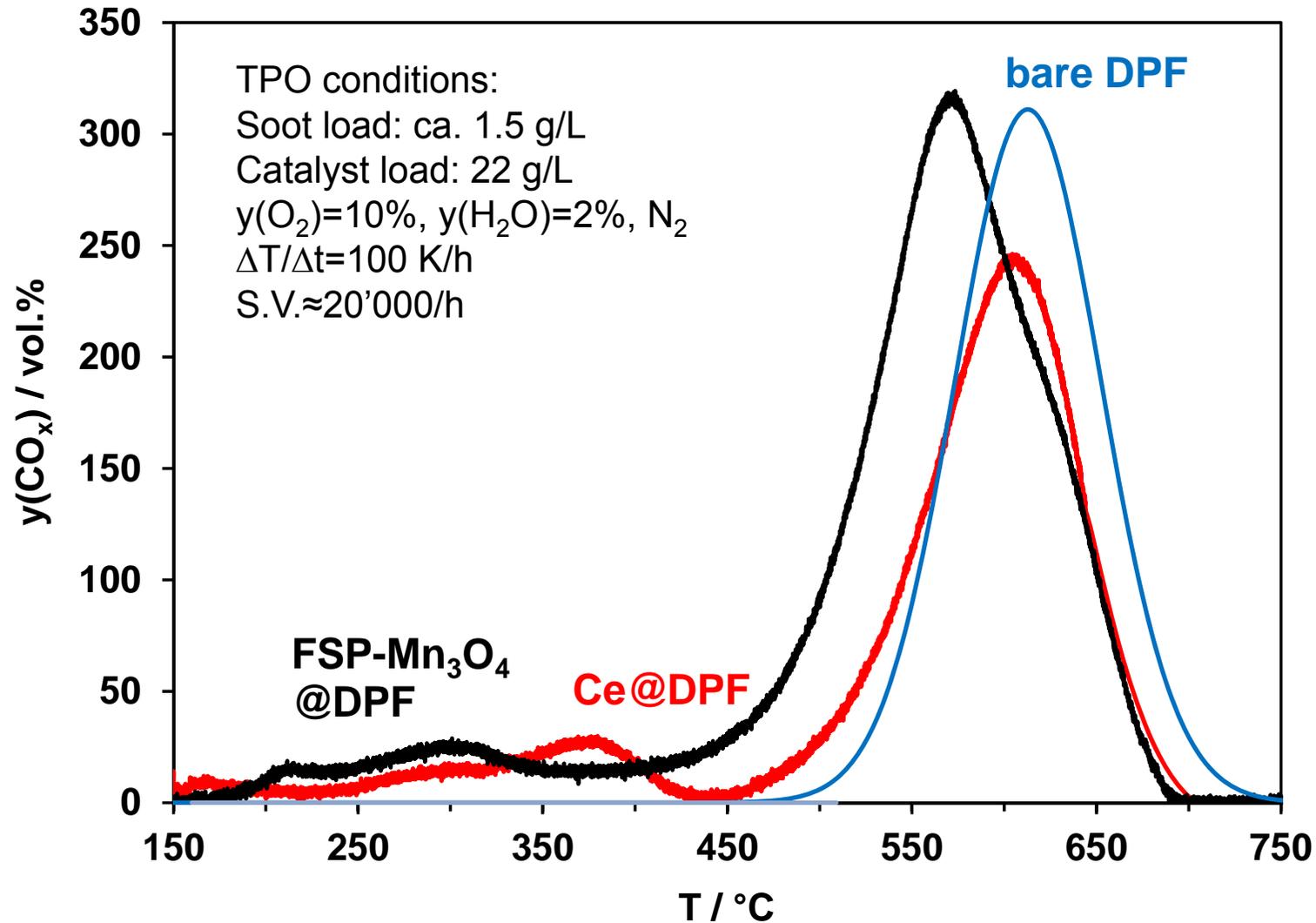
## Soot deposition on catalytic DPF



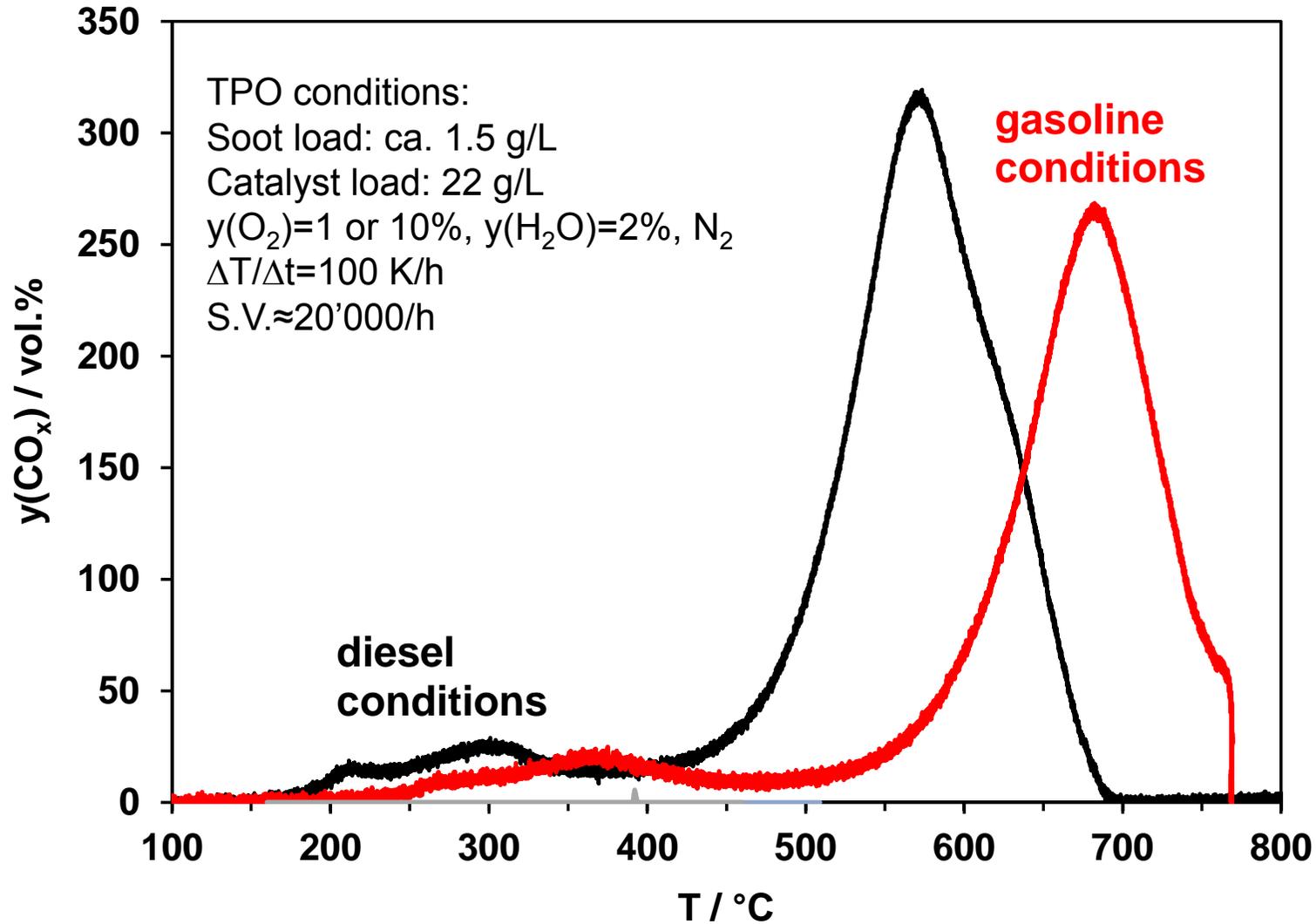
## TPO conditions

- Catalyst loading: 22 g/L
- Soot loading: ca. 1.5 g/L
- $y(\text{O}_2)=10\%$ ,  $y(\text{H}_2\text{O})=2\%$ ,  $\text{N}_2$  balance
- $F=6500 \text{ mL/min}$  (S.V. $\approx 20'000/\text{h}$ )

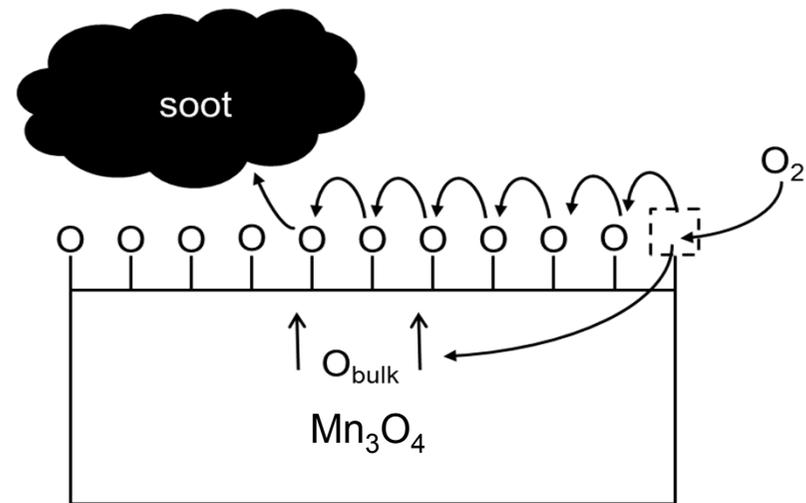
# Performance of lab-DPF coated with FSP-Mn<sub>3</sub>O<sub>4</sub> under diesel conditions



# Performance of lab-DPF coated with FSP-Mn<sub>3</sub>O<sub>4</sub> under diesel and lean gasoline conditions



- Manganese oxides are effective in soot oxidation and show high resistance towards thermal and hydrothermal aging
- Manganese oxide catalysts require intimate contact to soot
- FSP-Mn<sub>3</sub>O<sub>4</sub> strongly supplies bulk oxygen to soot
- Beneficial effect of FSP-Mn<sub>3</sub>O<sub>4</sub> also occurs onto particulate filters under diesel and lean gasoline conditions



We thankfully acknowledge the financial support from Umicore.

