Advanced Metal-Oxide based SCR Catalysts

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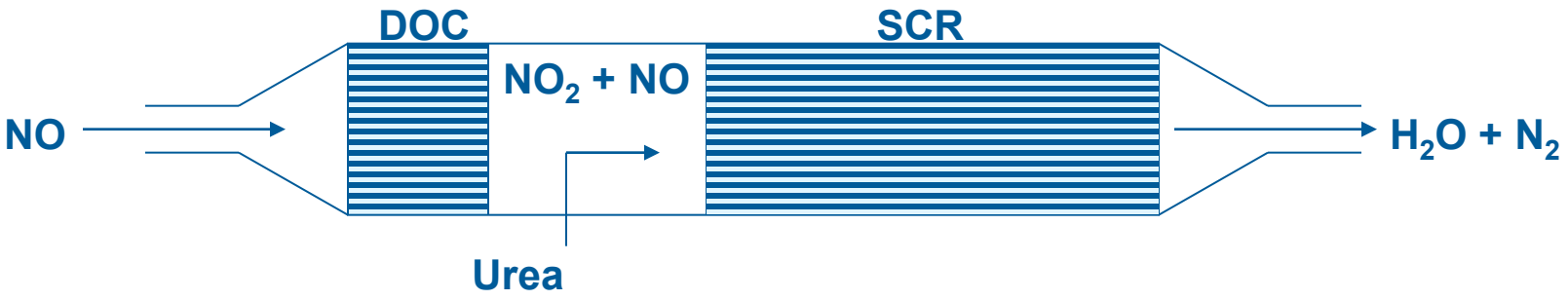
Agenda

- Introduction
- Current stage in the development of SCR catalysts
- Metal-oxide based SCR catalysts
  - NO-SCR activity & aging stability
  - NH_3 storage capacity
  - HC resistance
  - Start-up behaviour
- Summary

Introduction

NH_3-SCR – Basic Reactions



SCR-Reactions:

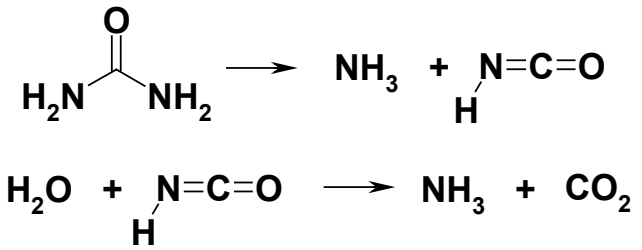
$4\ NH_3 + 4\ NO + O_2 \rightarrow 4\ N_2 + 6\ H_2O$ Standard SCR

$4\ NH_3 + 2\ NO + 2\ NO_2 \rightarrow 4\ N_2 + 6\ H_2O$ Fast SCR

NH_3 from Urea:

1) thermal decomposition of urea to Isocyanic Acid

2) catalytic hydrolysis of Isocyanic Acid to NH_3



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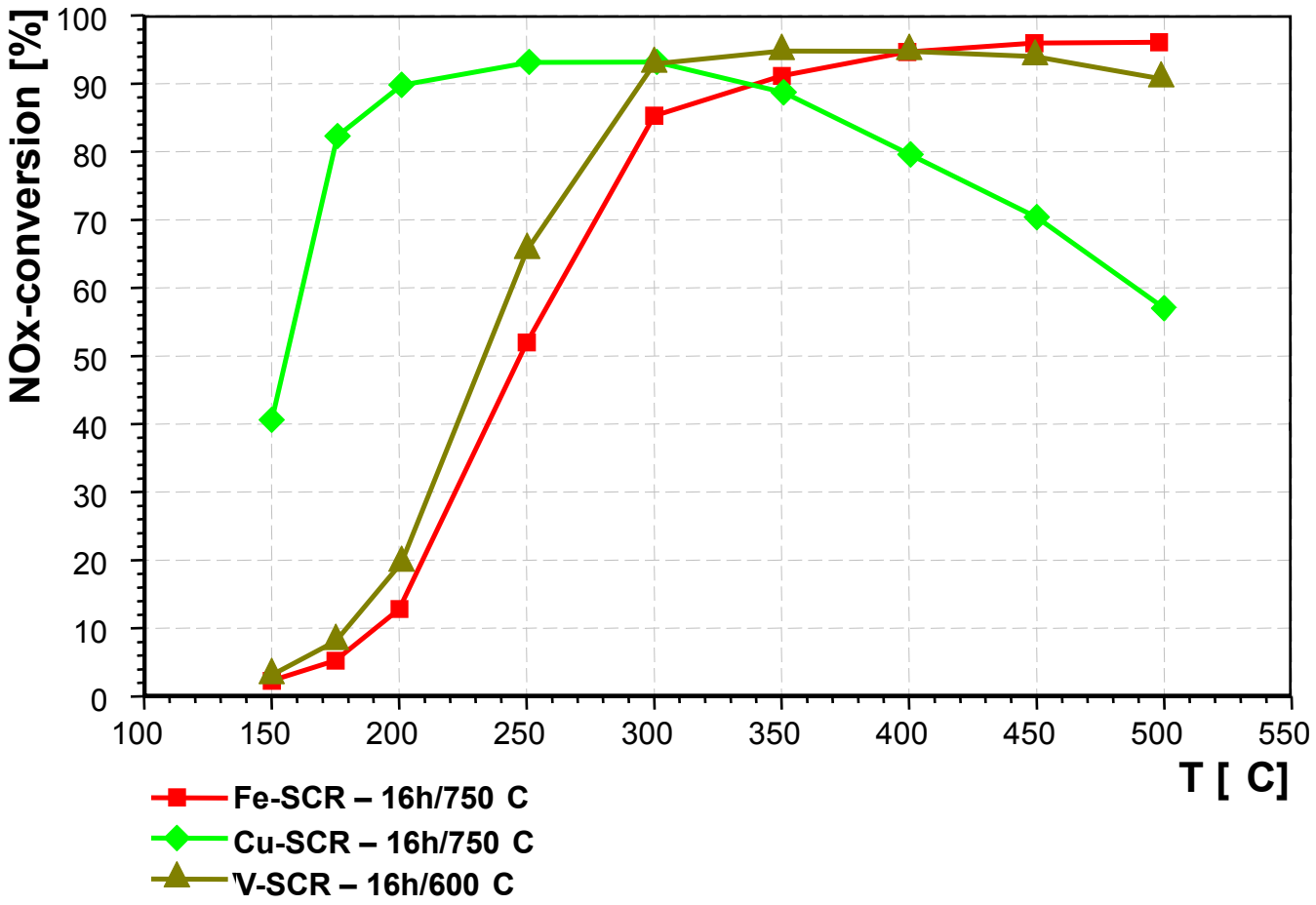
Current Status

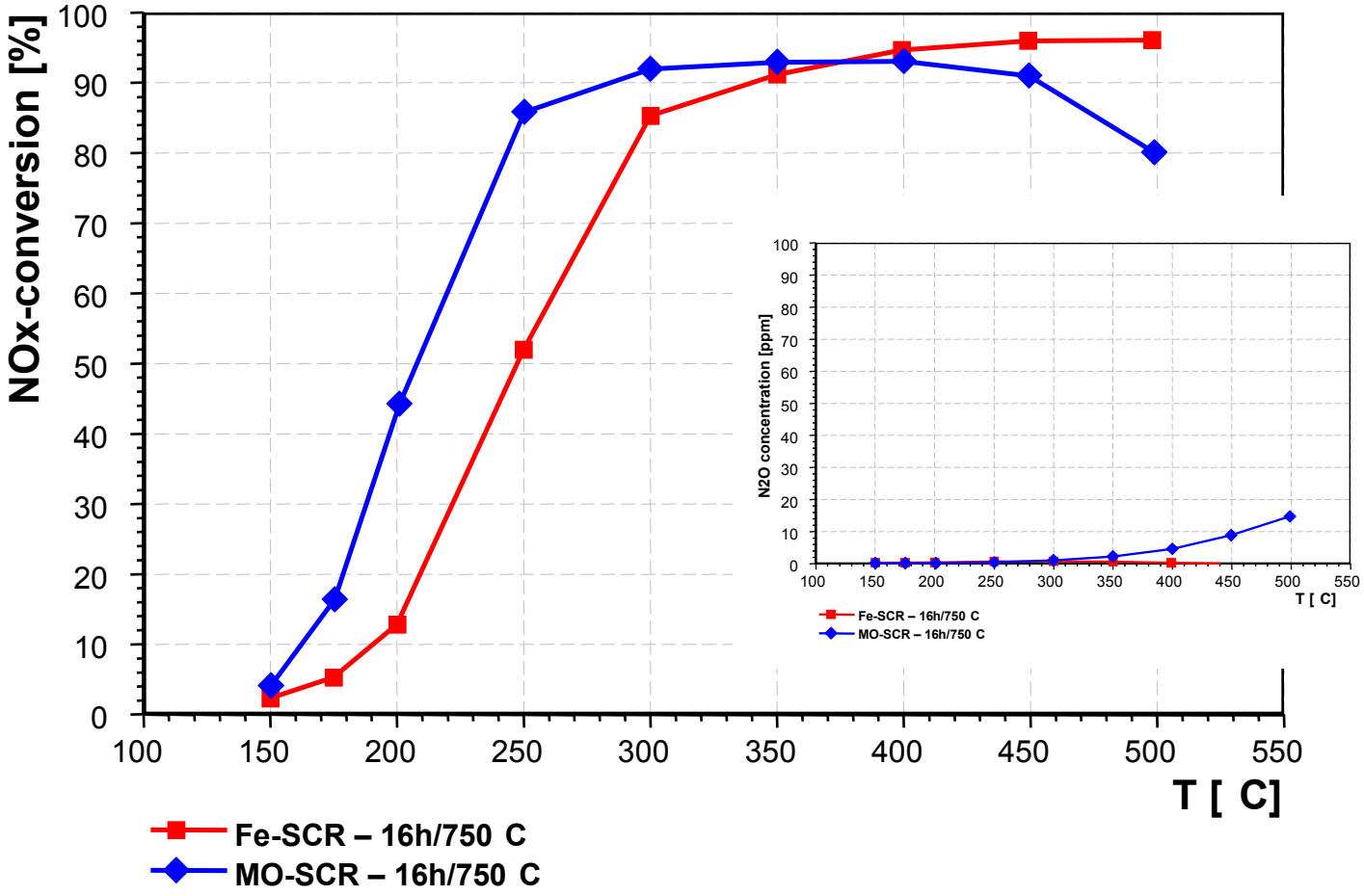
From V-based to Zeolite-based Catalysts

NOx Conversion of State-of-the-art SCR Families

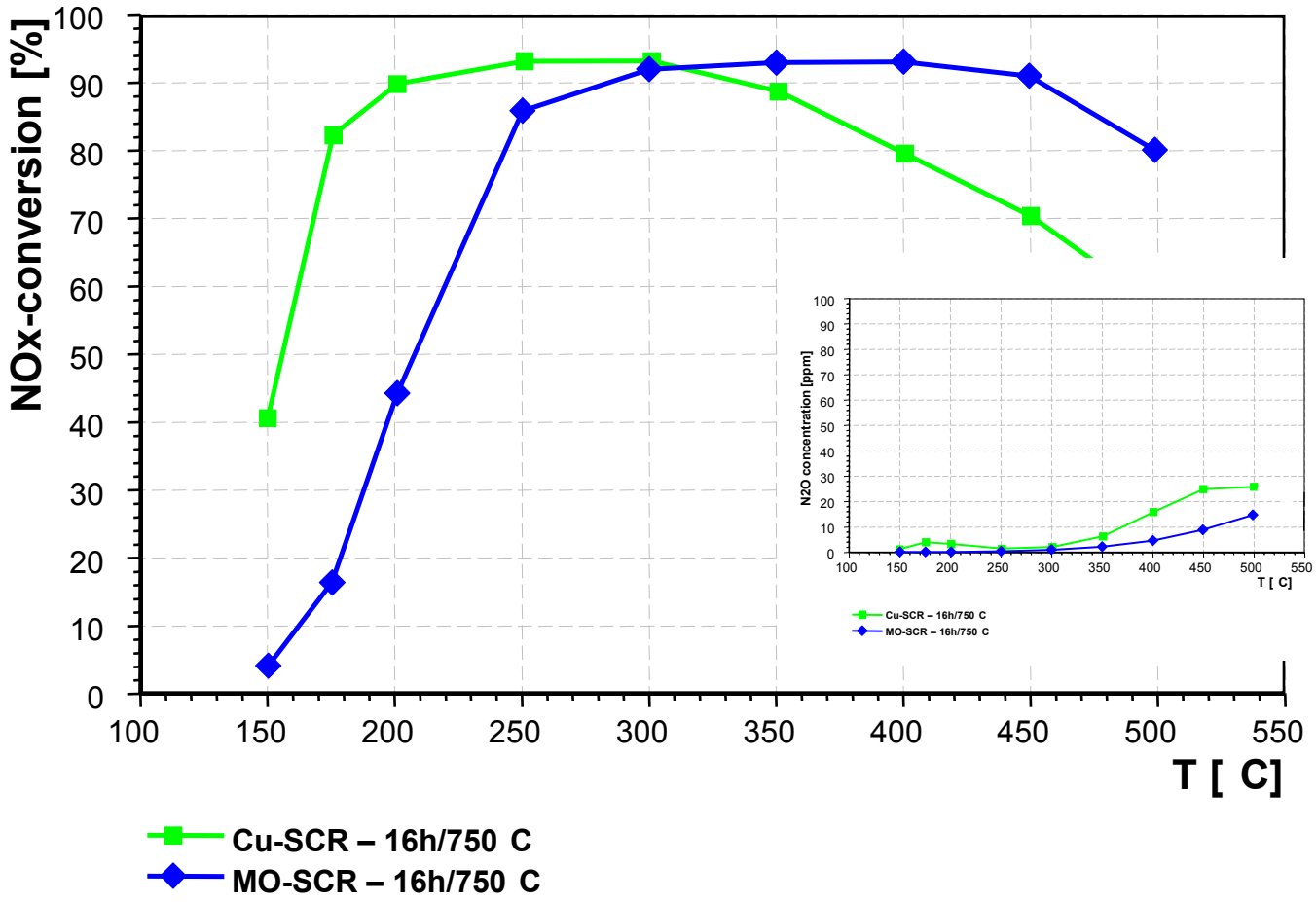


Metal-Oxide based SCR Catalysts

NOx Conversion compared to Fe-zeolite



NOx Conversion compared to Cu-zeolite



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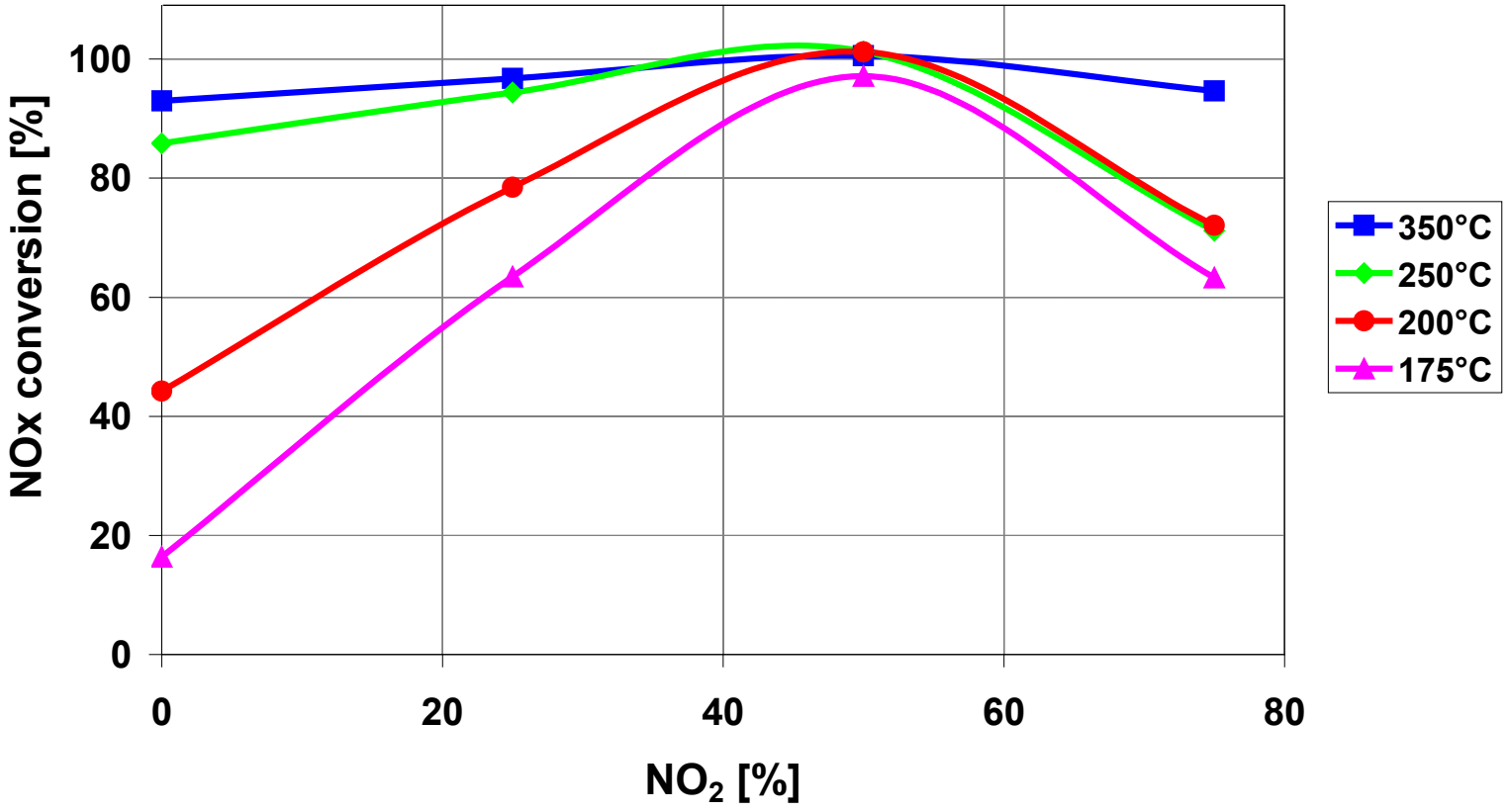
Impact of NO/NO_2 Ratio



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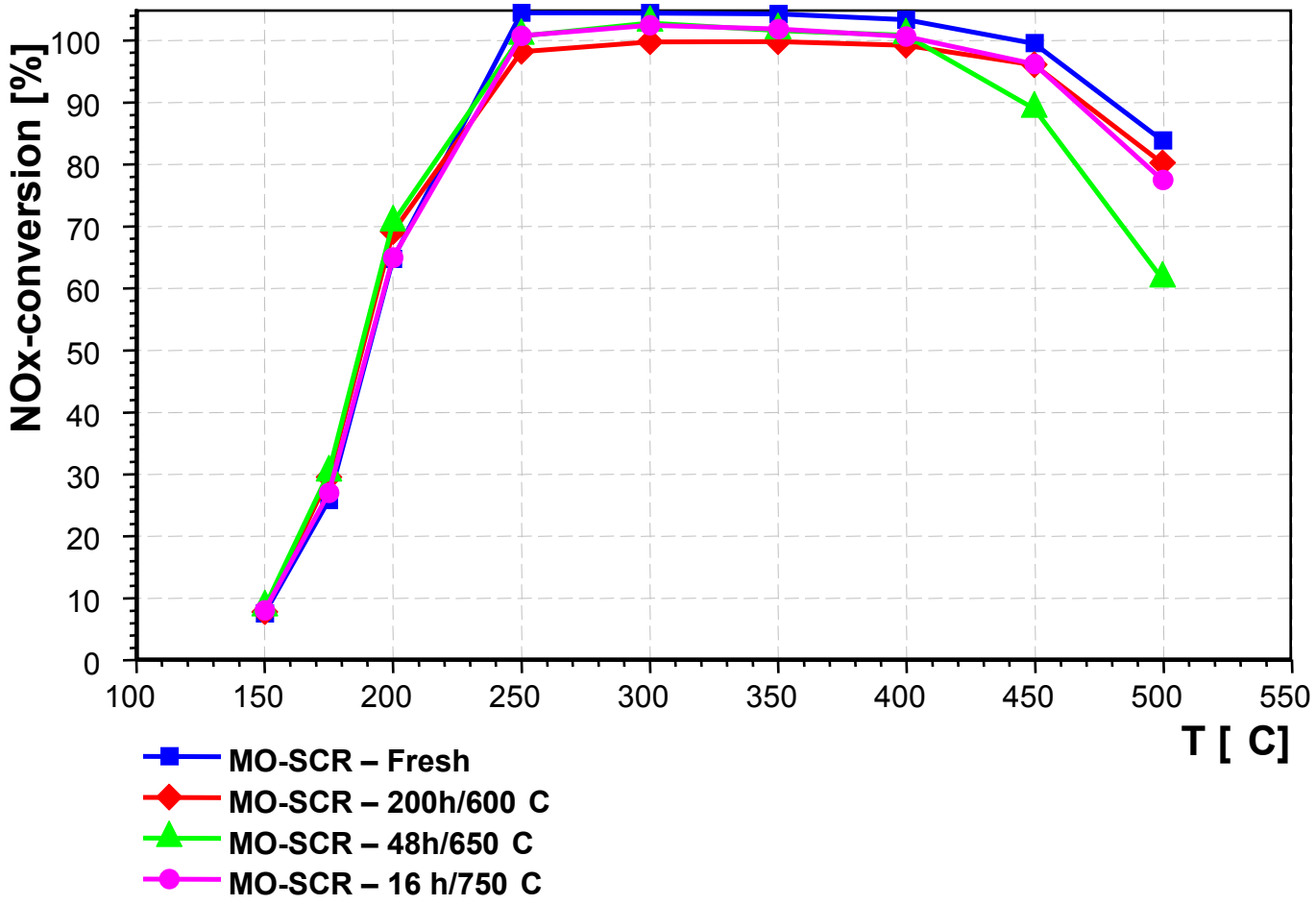
MO-SCR – Aging Influence



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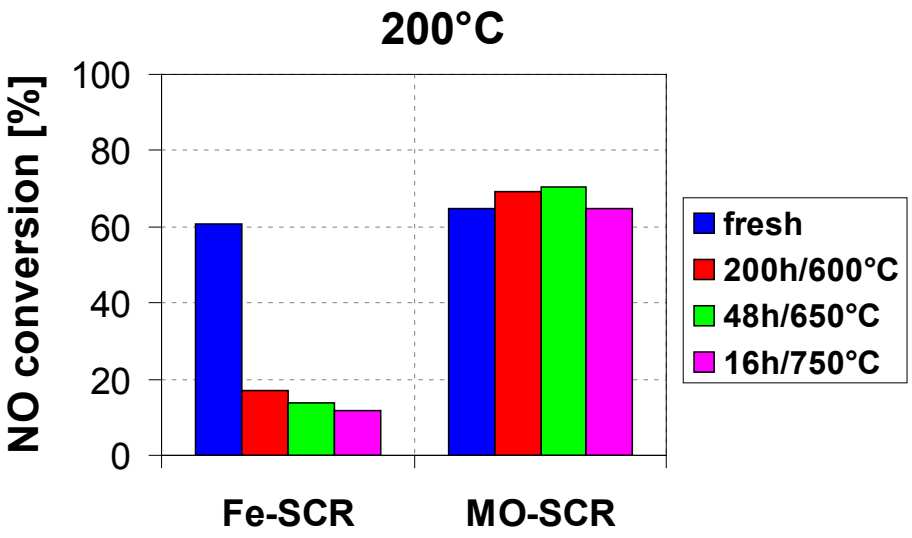
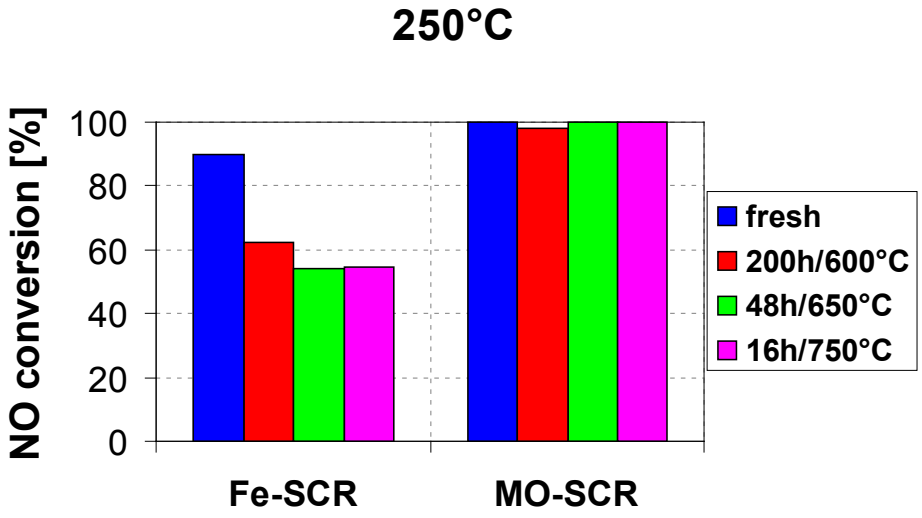
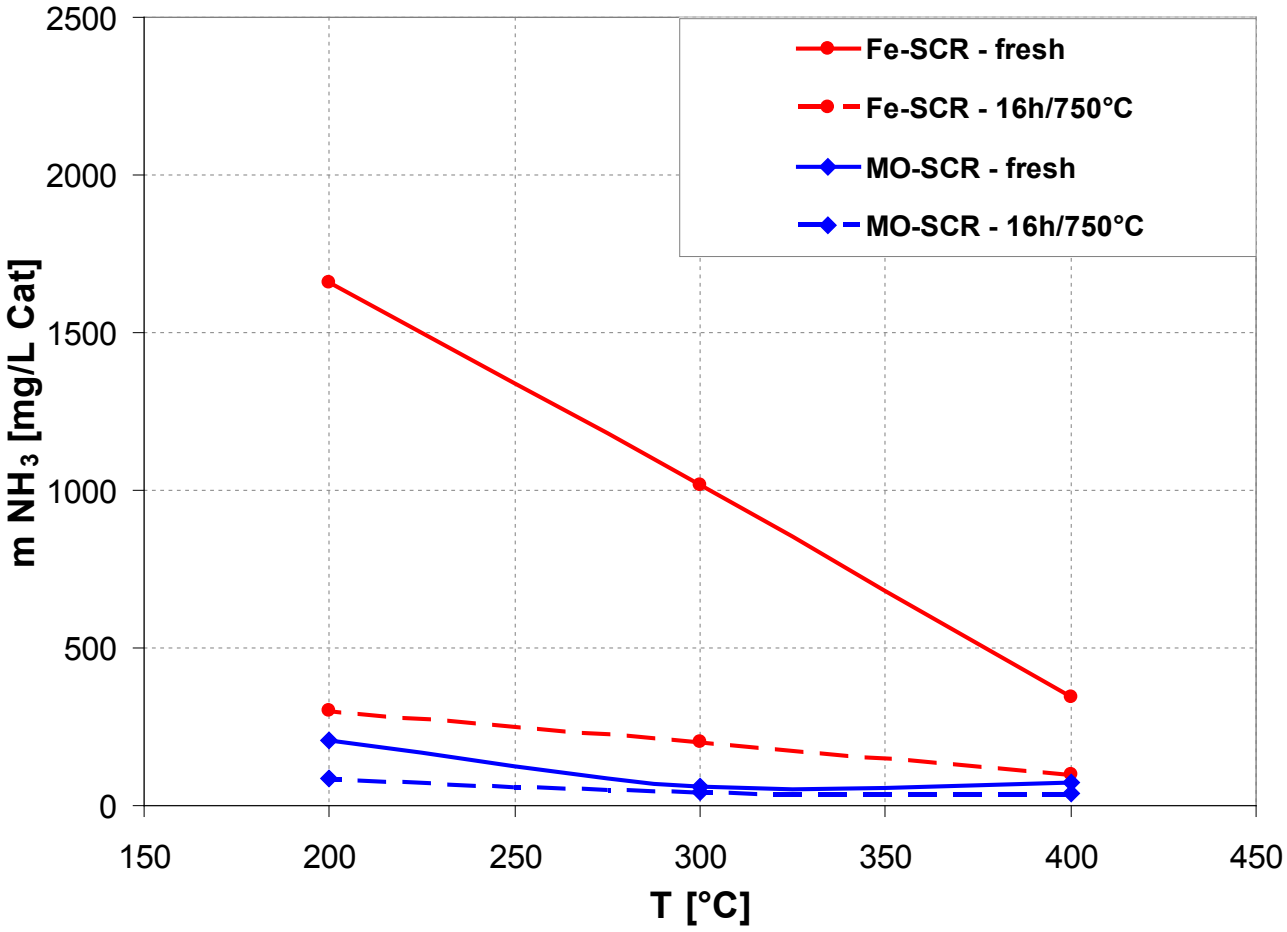
Aging Stability compared to Fe-zeolite





- Very high aging stability compared to Fe-zeolite

NH_3 Storage Capacity



Target:

- stable NH_3 storage

a) over temperature

b) over aging

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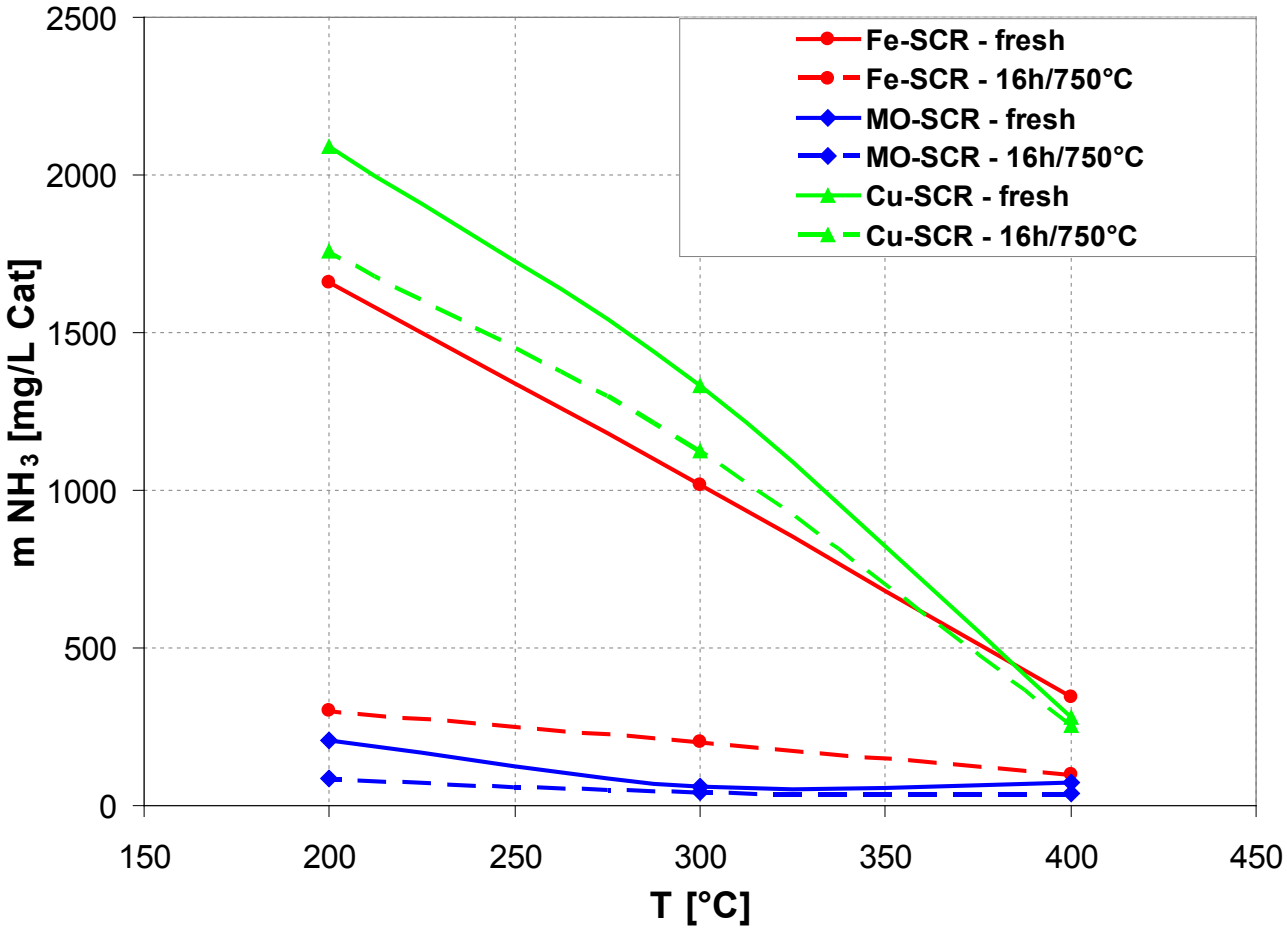
NH_3 Storage Capacity



Target:

- stable NH_3 storage

a) over temperature

b) over aging

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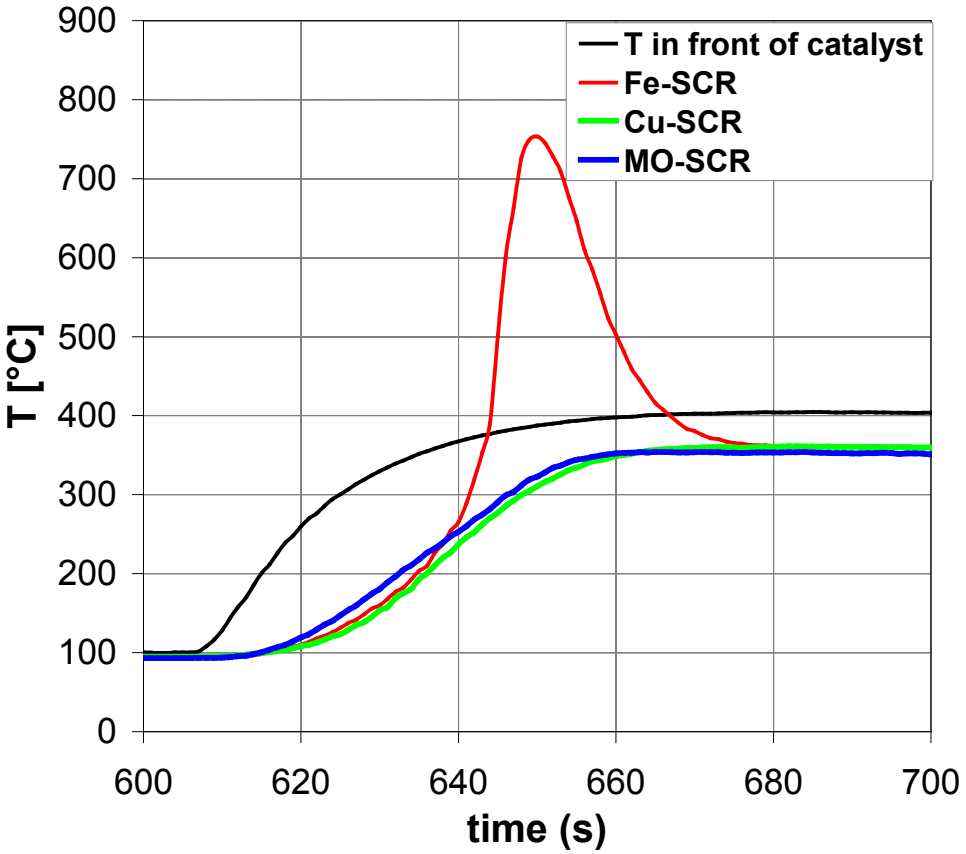
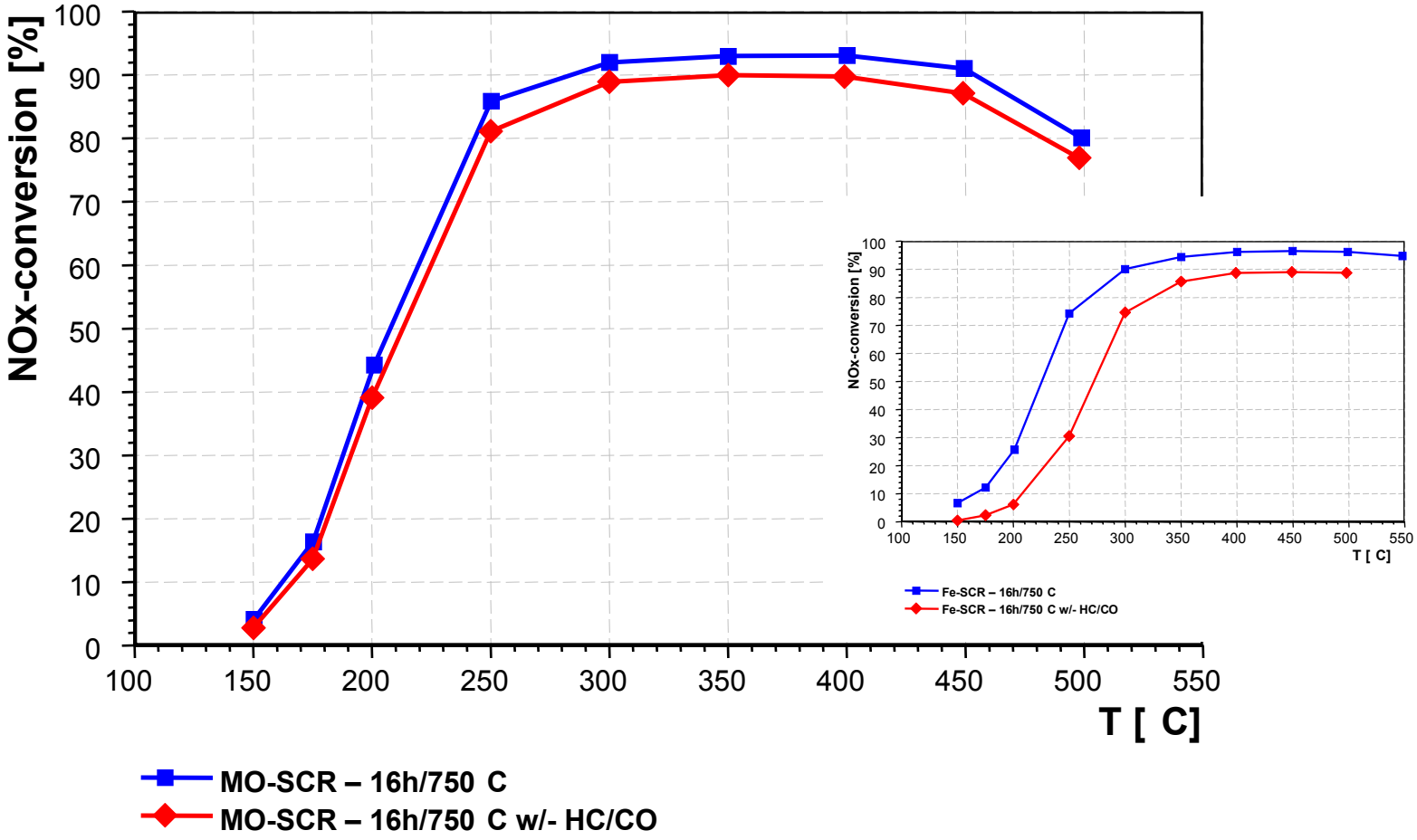
Impact of HC/CO – Exotherm Generation



Risk:

- Thermal damage by exotherm generation e.g. over acceleration phase after HC storage

Influence of HC/CO



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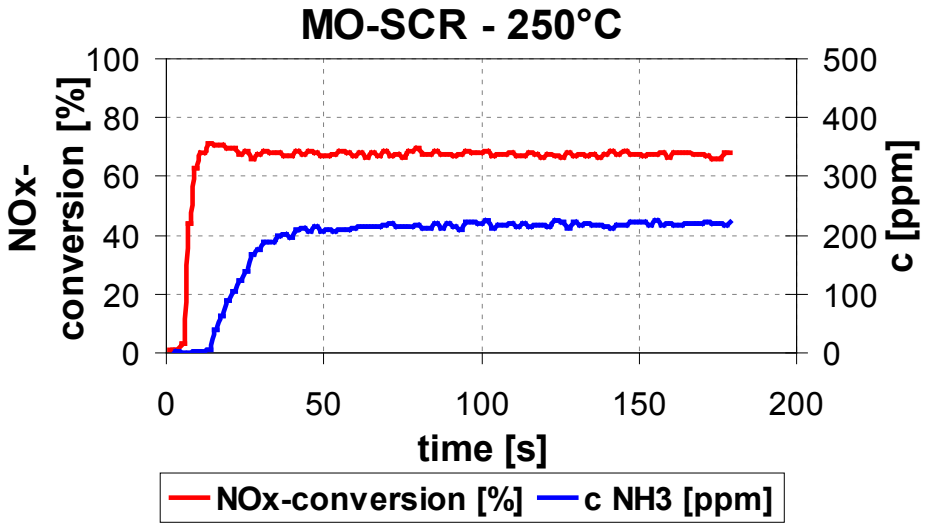
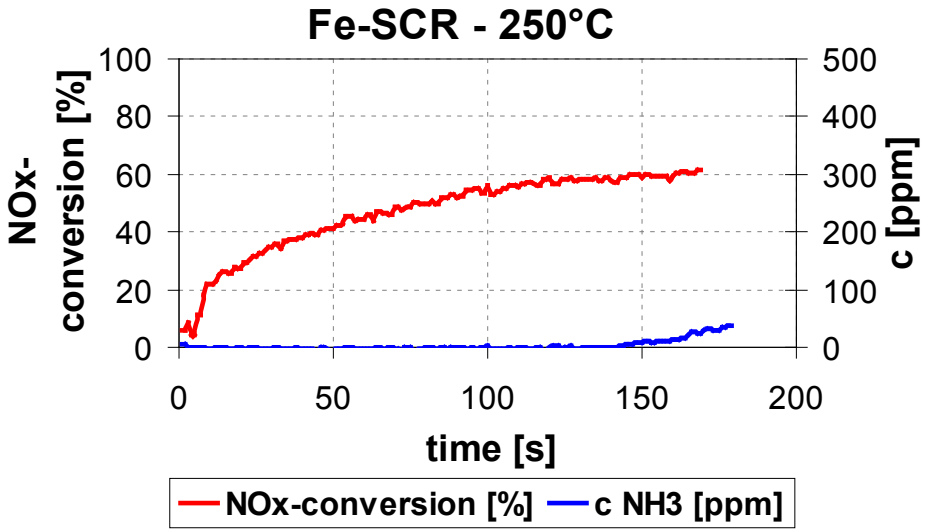
Dynamic Start-up





- High dynamic start-up compared to Fe-SCR
- Fast NH_3 break-through in case of overdosing

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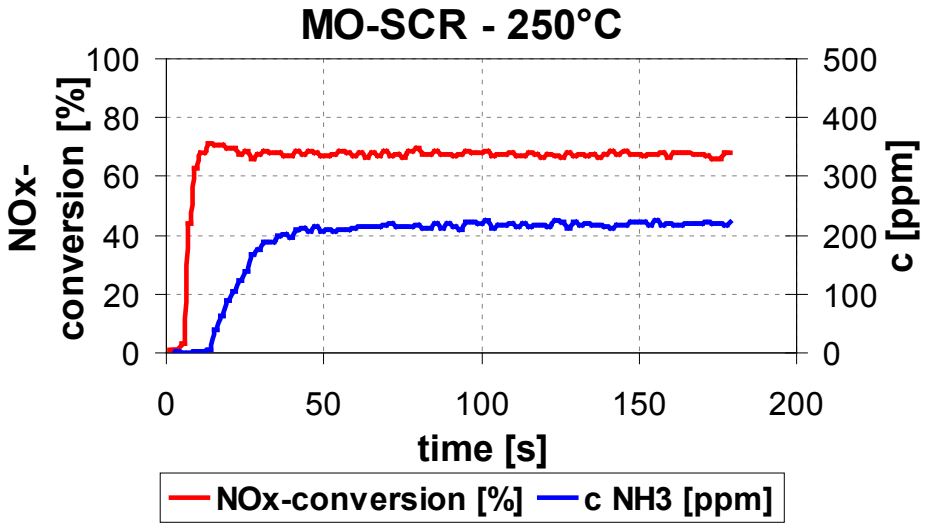
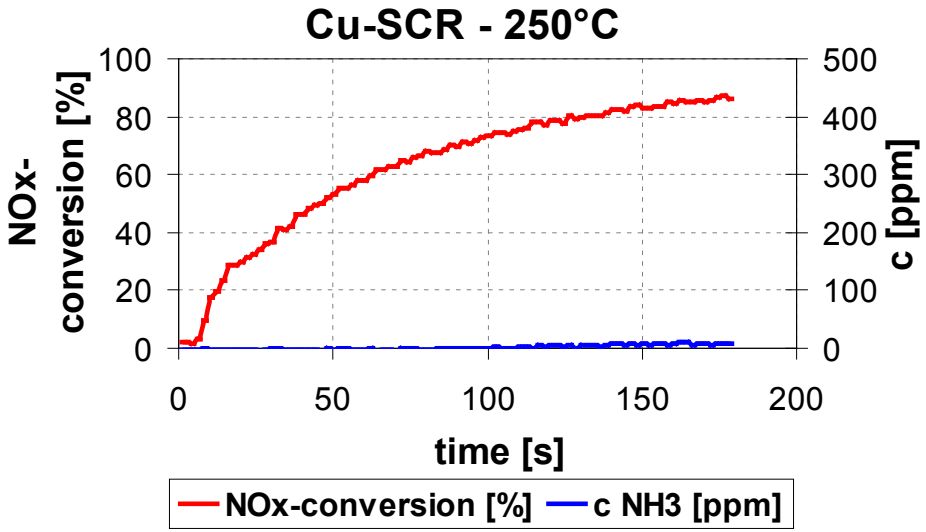
Dynamic Start-up





- High dynamic start-up compared to Cu-SCR
- Fast NH_3 break-through in case of overdosing

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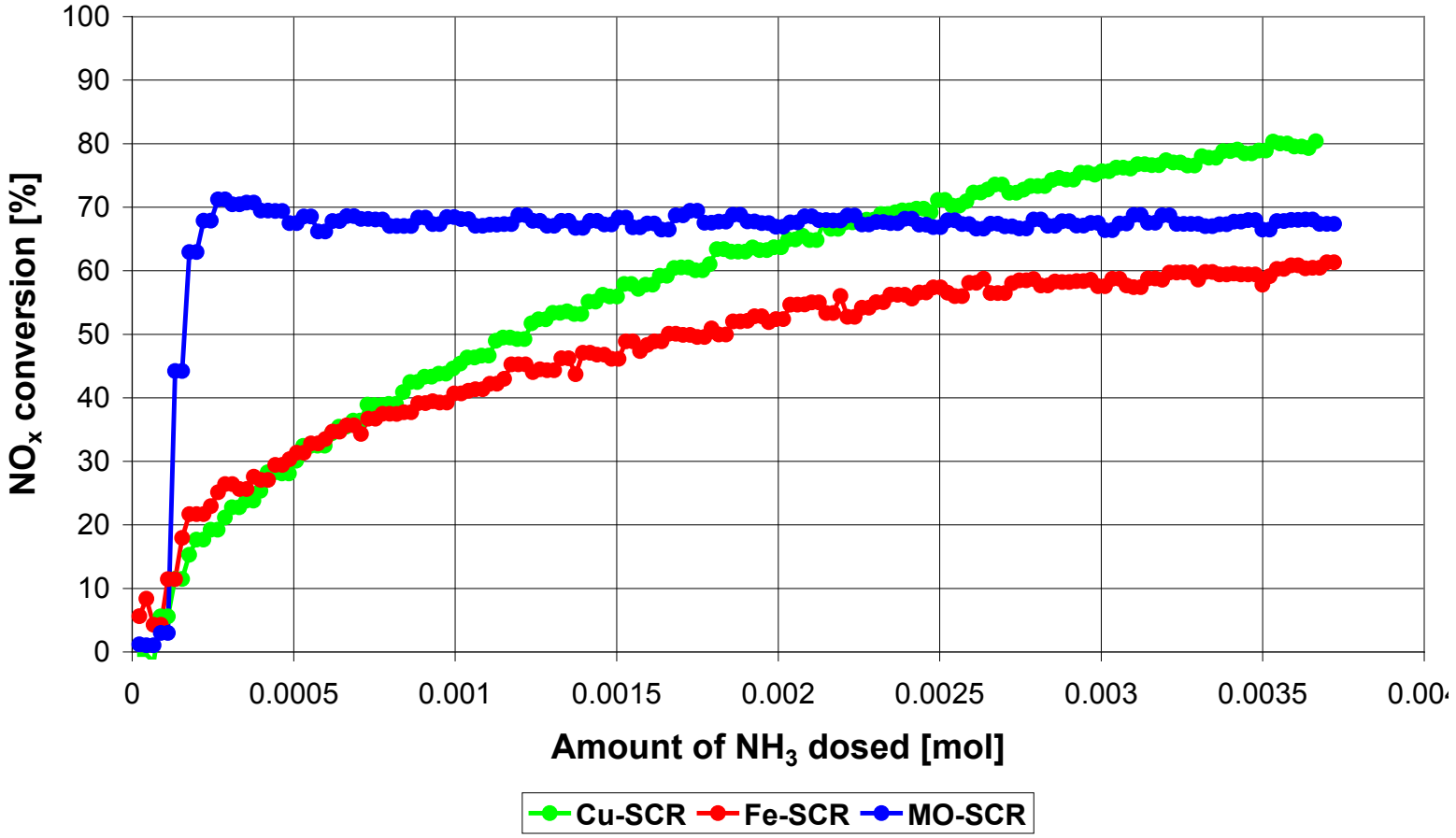
NOx Conversion *vs.* Amount of NH_3 dosed



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Summary

Characteristics of Metal-Oxide based SCR Catalysts

- Improved low temperature performance compared to Fe-zeolites
- No significant N_2O formation
- High aging stability
- Stable NH_3 storage over temperature & over aging
- High tolerance towards hydrocarbon, no risk of exotherm generation
- High dynamic start-up behaviour


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