

Selective Catalytic Reduction In Automotive

Zdeněk Král

Selective Catalytic Reduction ...in general

- **Wide technique of NO_x removal**
 - Used everywhere, where NO_x is produced (and undesired)
 - Used mainly for exhaust gases (chimneys, exhausts, ...)
- **Selective**
 - We can select which molecule will be reduced (NO_x, CO, CO₂, SO₂)
- **Catalytic**
 - Reaction needs to be catalysed.
- **Reduction**
 - NO_x to N₂

SCR in automotive

- Reduction of NO_x using reduction agent on a surface of solid catalyst in presence of oxygen

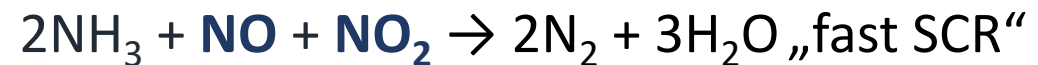
- Summary equation:



- Other SCR reactions:

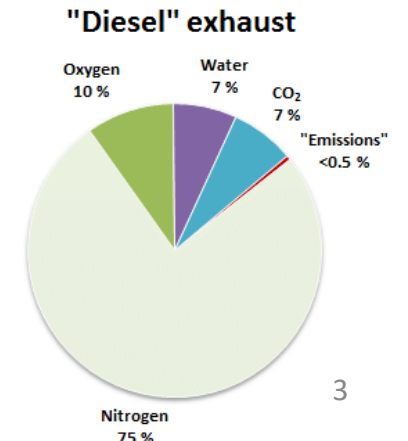
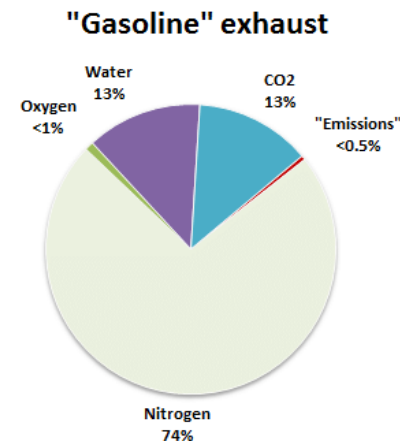


... plus many side reactions



- Reduction agent

- Needed for high conversion rates
- **NH₃**, HC (hydrocarbons)



... a bit of History

- SCR was developed for industrial applications
 - 70s - applied in thermal power plants in Japan
 - Since 80s – widespread to Europe and USA
- First mobile applications (not powerplants)
 - 90s Korean cargo ships (diesel engine = electric generator)
 - Reason for this application - similar application as in powerplants, steady state of engine operation



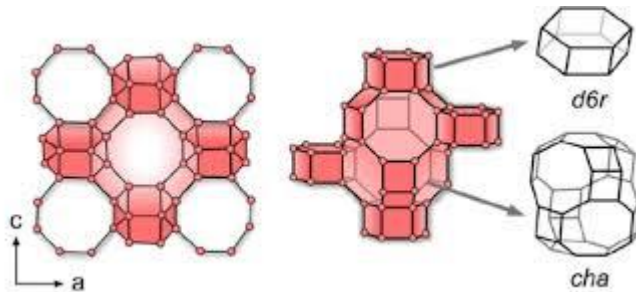
How does SCR catalyst look like?

- Ceramics carrier with active substance
 - SiC, Cordierite
- „Mate“
 - Heat resisting dense fibers
 - Spacer for thermal dilatation
- Metal housing
 - Stainless steel



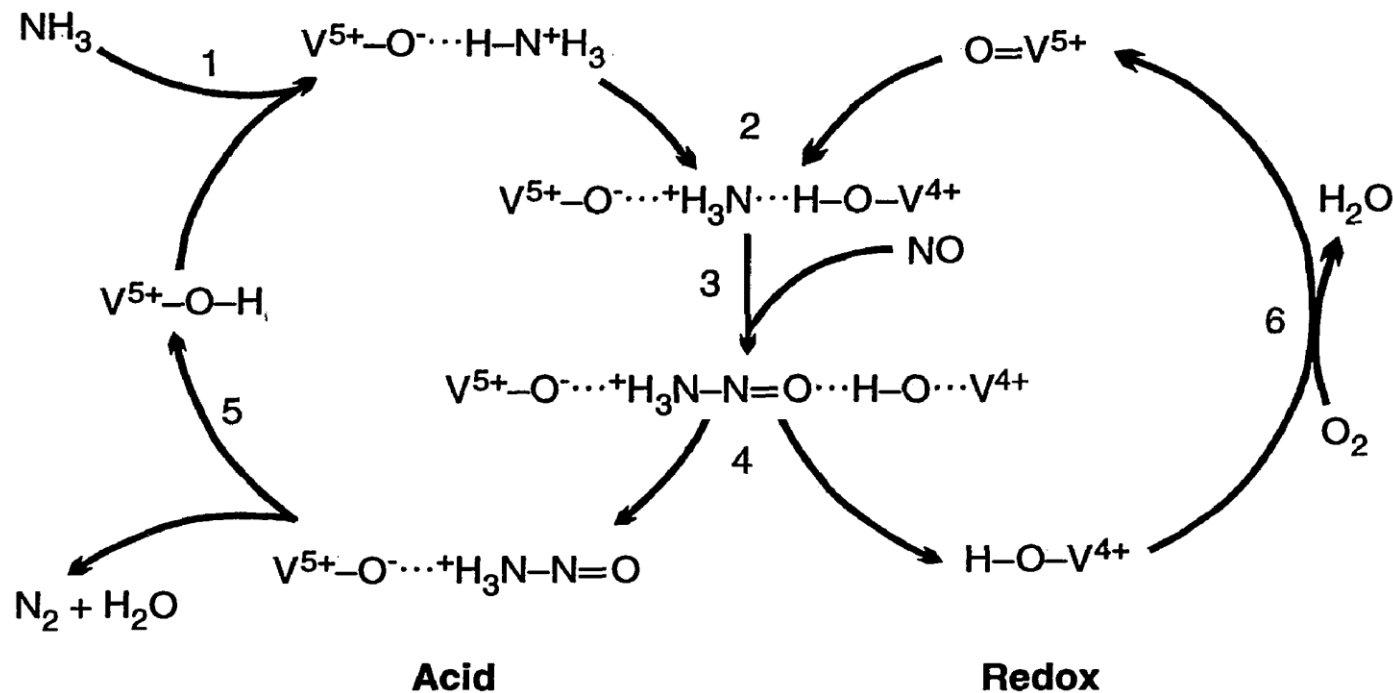
What is the active substance?

- Several substances are catalytically active enough to be used for SCR
- Cu and Fe zeolites (Cu-SSZ-13, Fe-ZSM5)
- Metal oxides (V_2O_5)

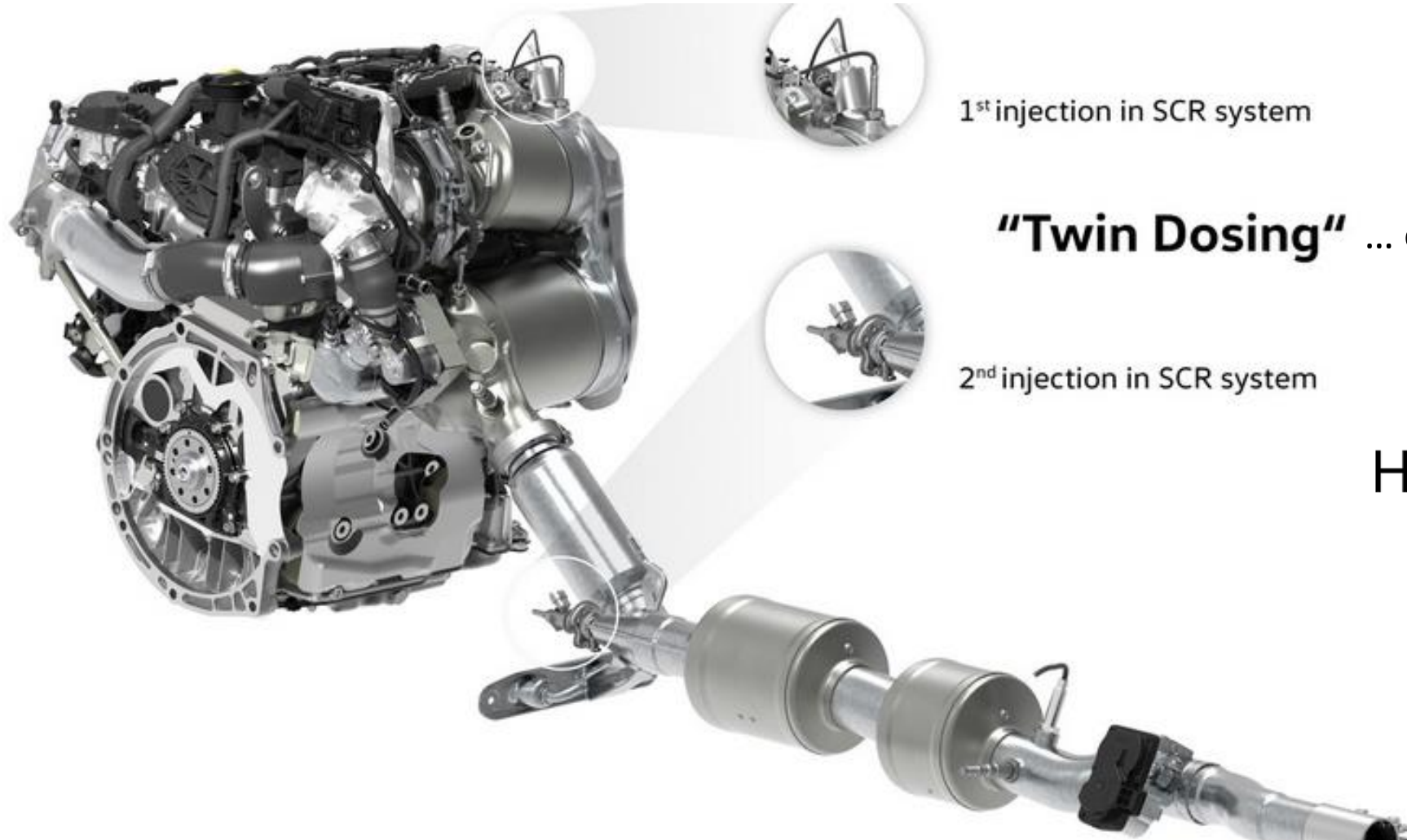


What is the mechanism?

- Mechanism is strongly dependent on exact composition of the material



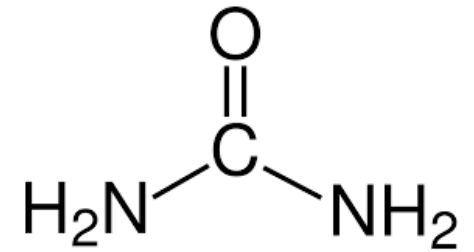
„State of the Art“



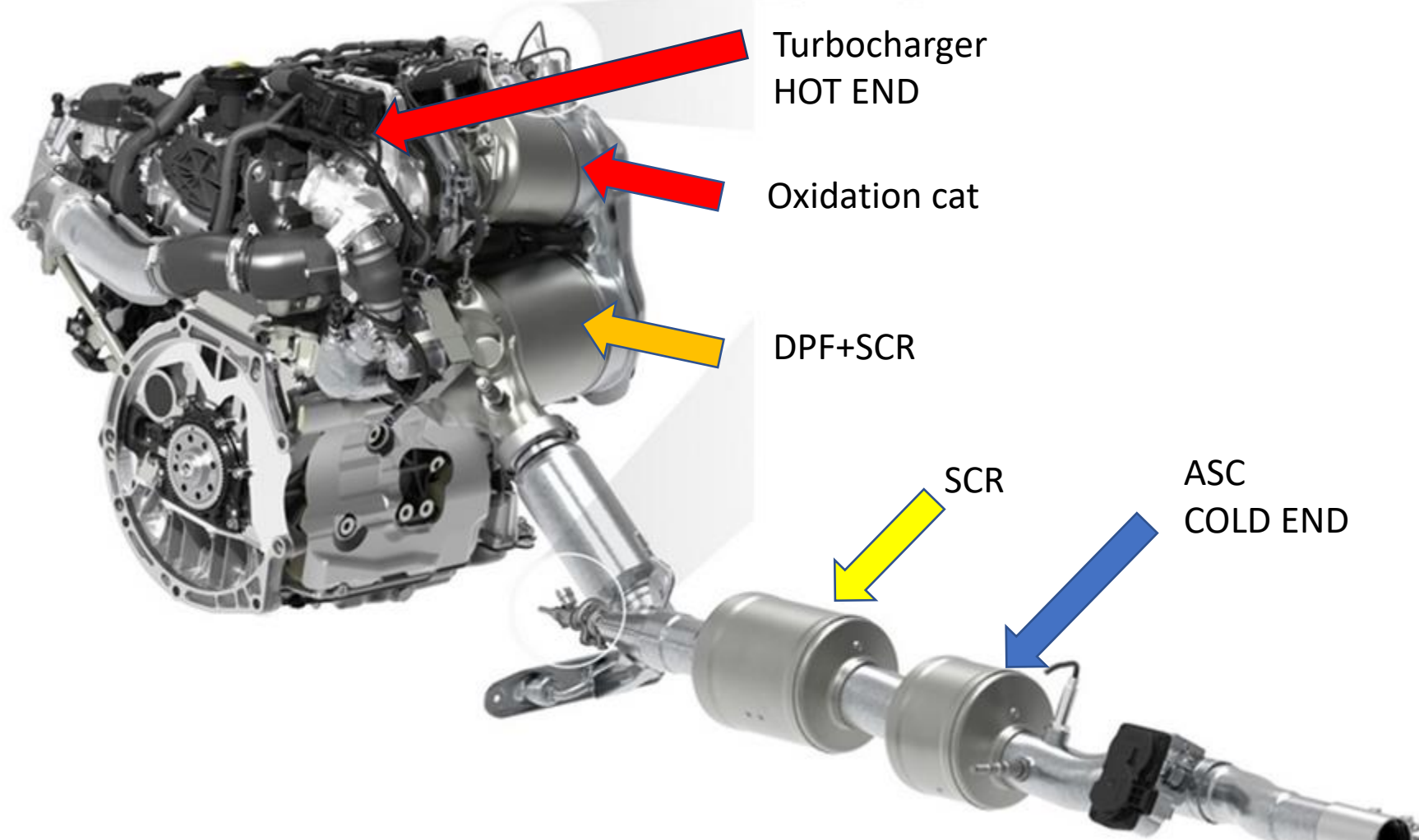
1st injection in SCR system

“Twin Dosing” ... of urea

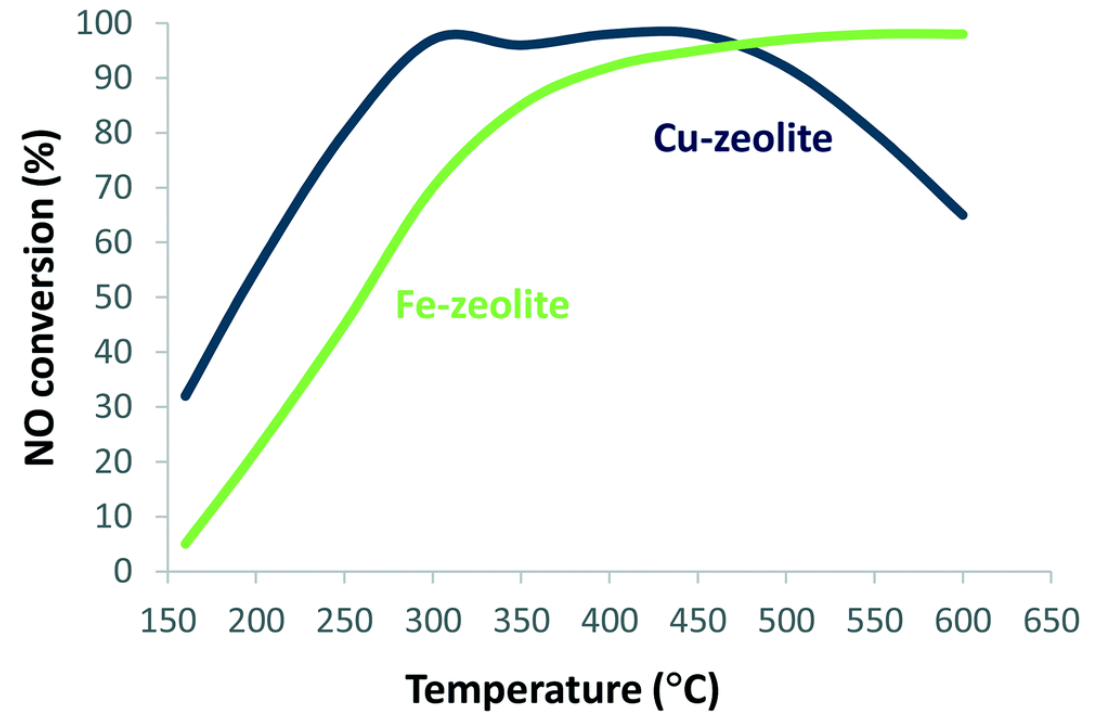
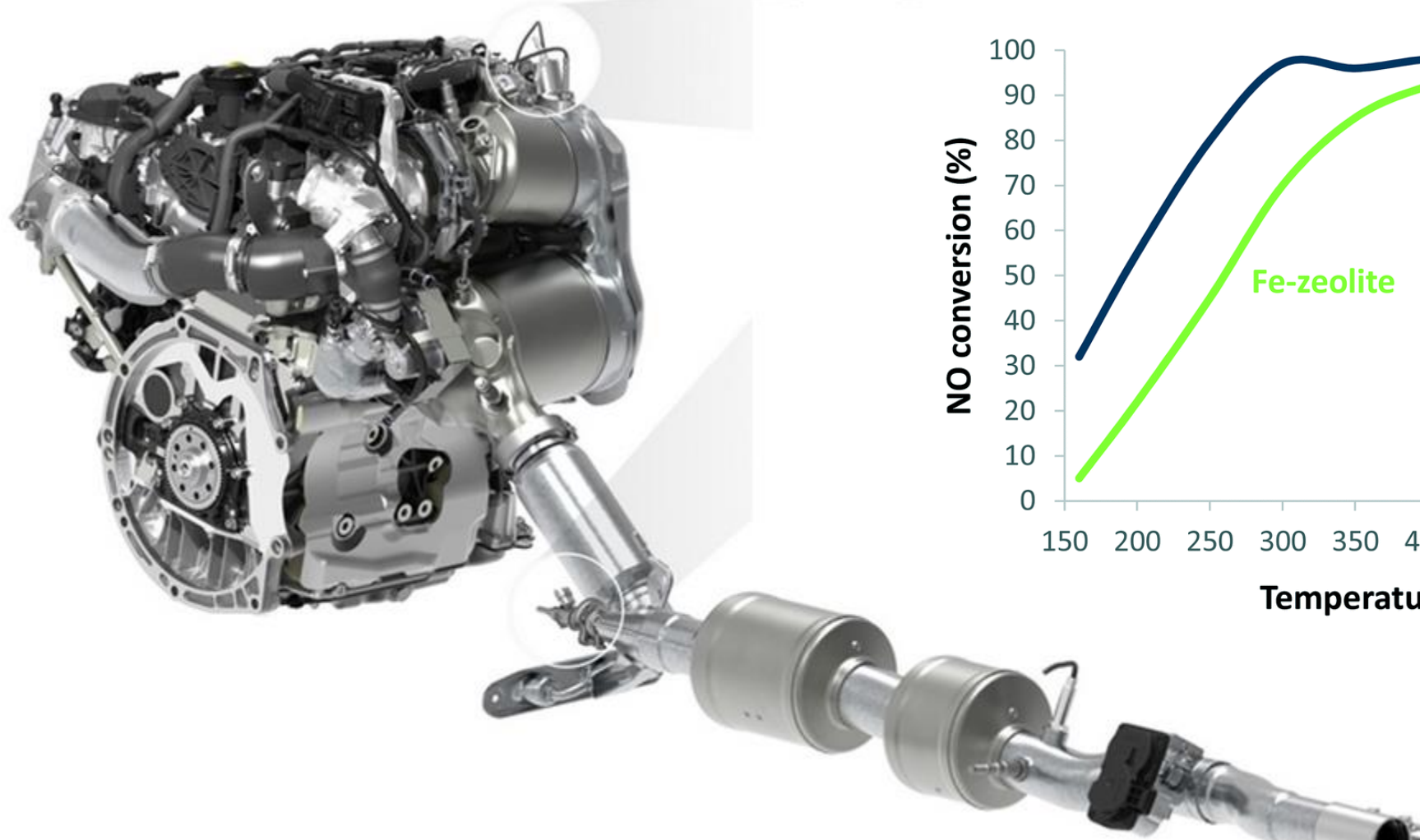
2nd injection in SCR system



SCR in Automotive



SCR in Automotive



NH₃-SCR in Automotive

