PAUL SCHERRER INSTITUT

PSI

Wir schaffen Wissen – heute für morgen

Paul Scherrer Institut

Daniel Peitz

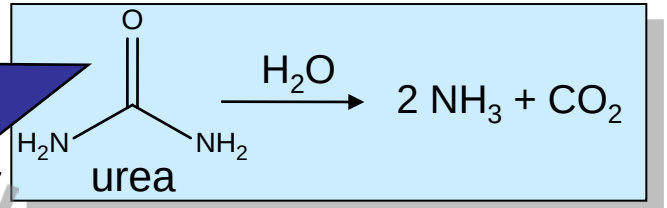
Investigations on the catalytic decomposition of guanidinium formate, ammonium formate and methanamide as NH_3-precursors for the selective catalytic reduction of NO_x

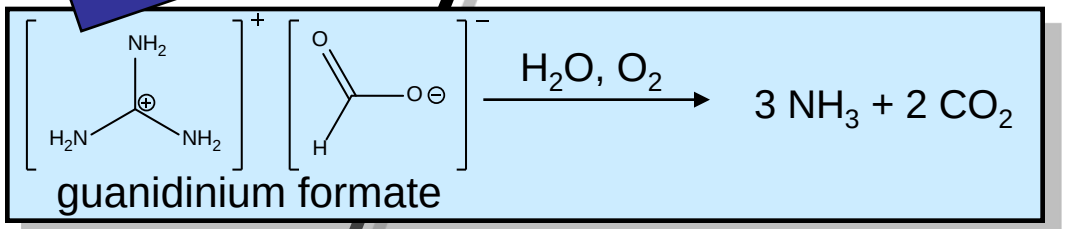
State of the art Diesel exhaust gas aftertreatment

Hydrolysis catalyst and mixer

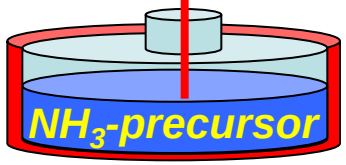
Diesel particulate filter

substitute





CO, *HC*, NO_x, soot



N_2, O_2, H_2O, CO_2

NO_x-sensors

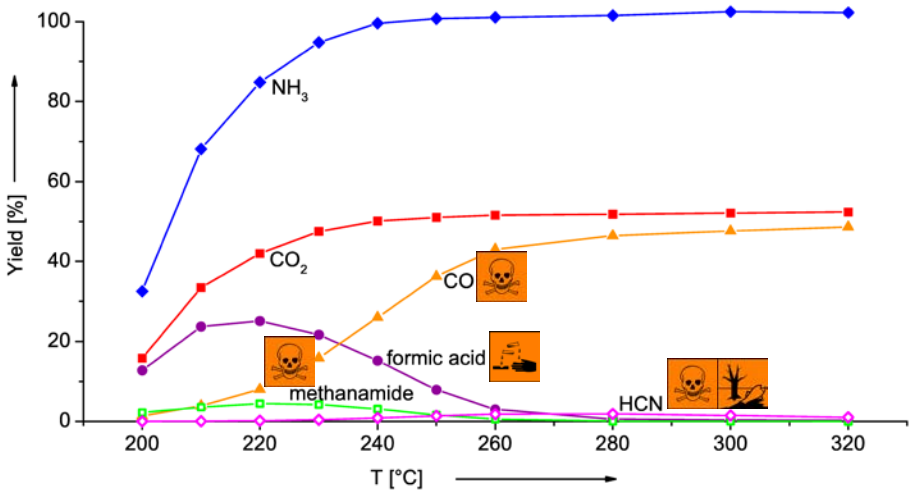
Diesel oxidation catalyst

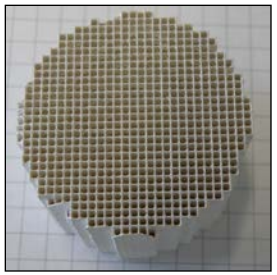
Selective catalytic reduction

NH_3-slip catalyst

Decomposition of guanidinium formate

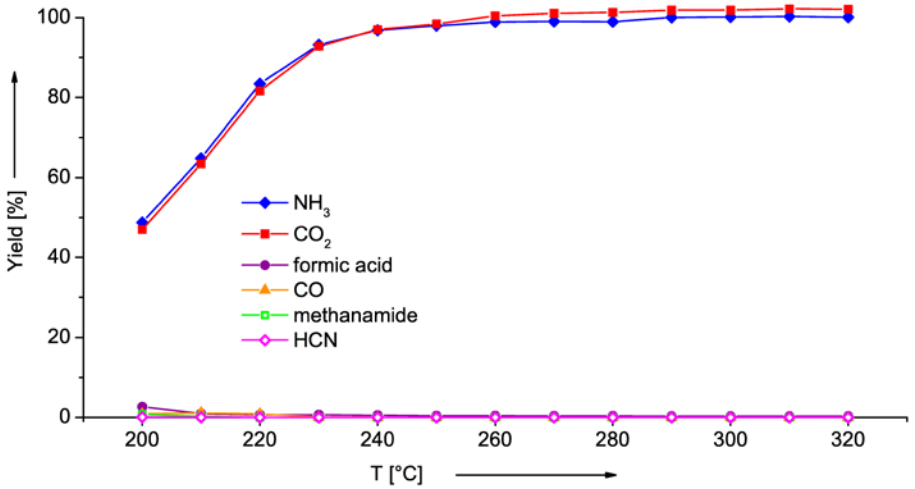
Commercial TiO_2 (anatase) hydrolysis catalyst (provided by Cristal Global), coated at PSI

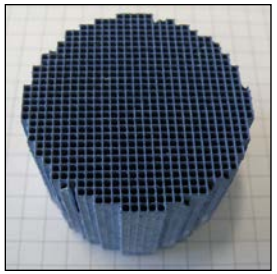




large percentage of toxic and corrosive side products

1.5% Au doped TiO_2 (anatase) hydrolysis catalyst (prepared at PSI), coated at PSI

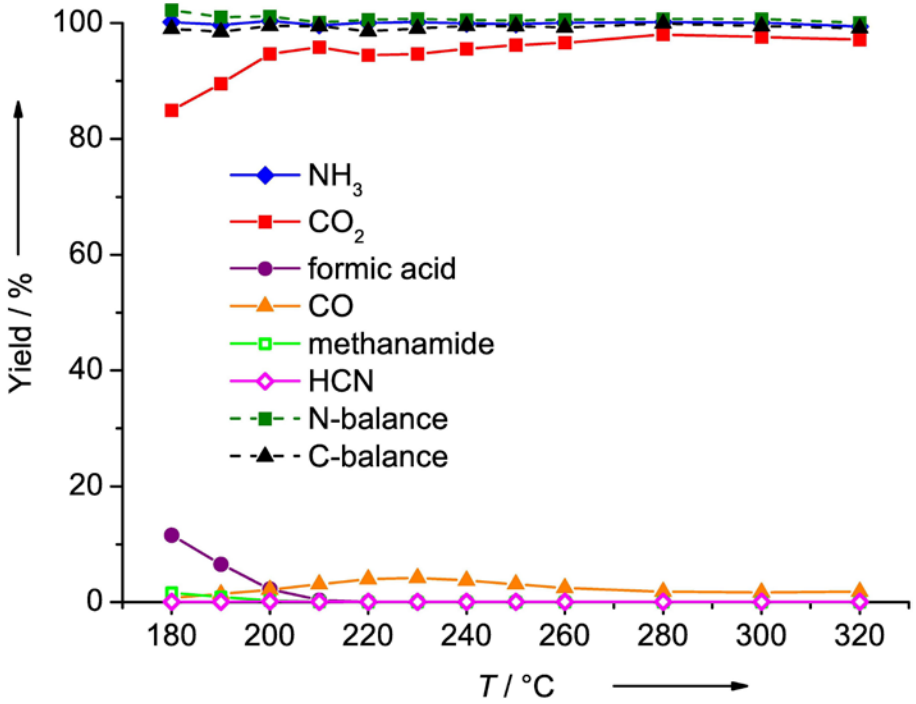




virtually no side products

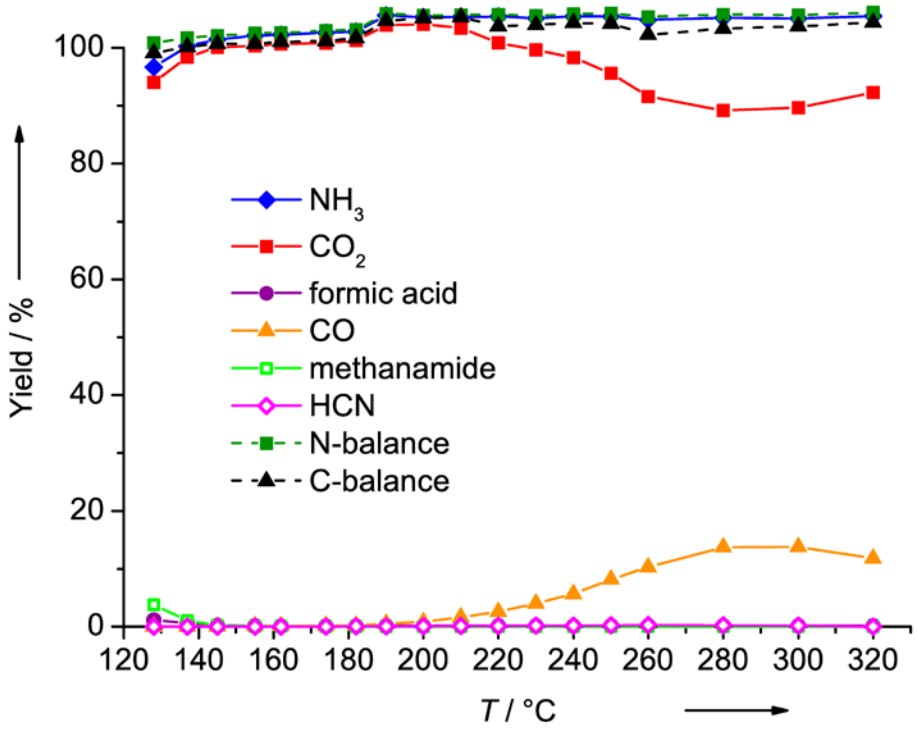
Decomposition of AmFo and Admide®

1.0% Au doped TiO_2 (anatase) hydrolysis catalyst (GHSV = 19900 h^{-1})



40% Ammonium formate in water (AmFo)

≥ 210°C full NH_3 release, no side products*



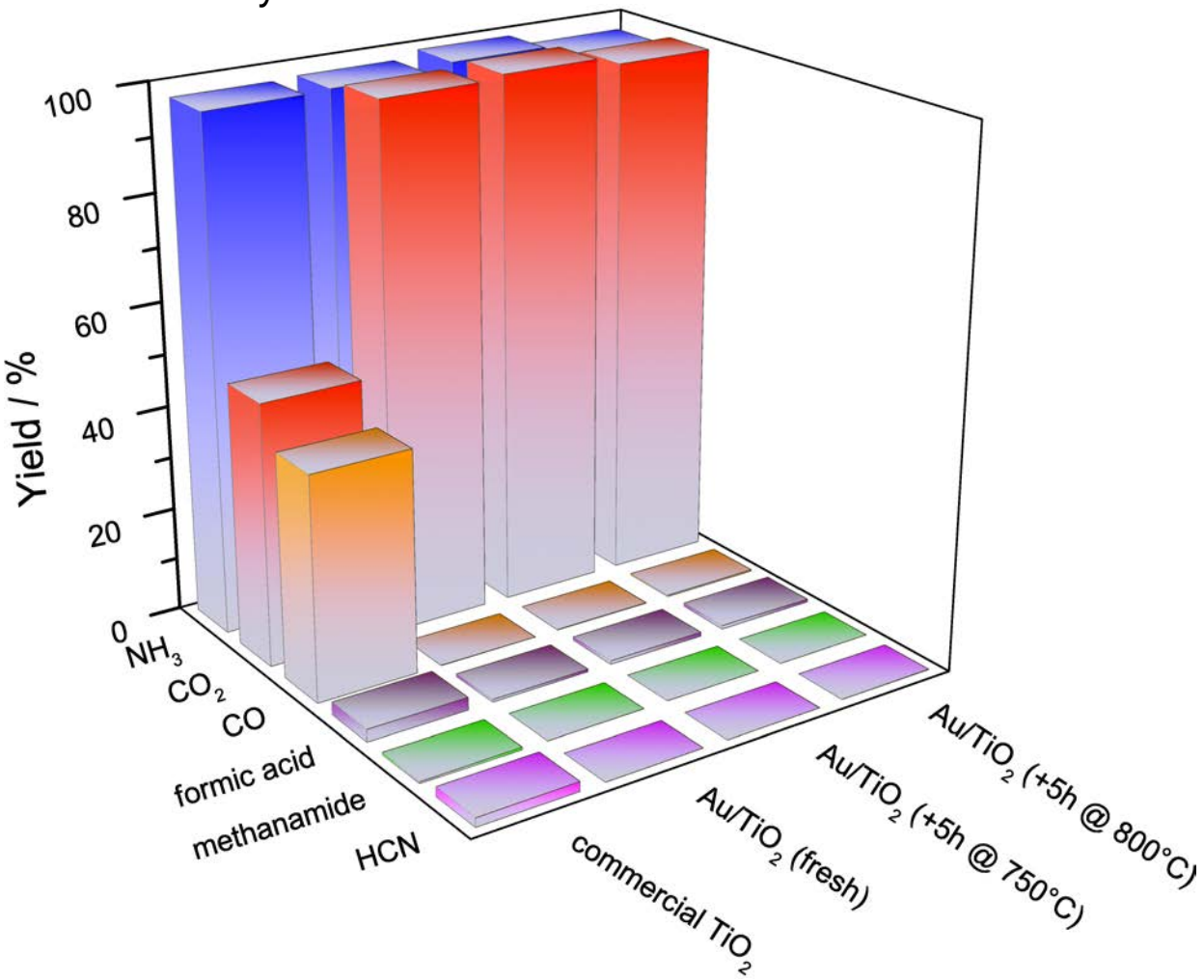
80% Methanamide in water (Admide®)

≥ 145°C full NH_3 release, no side products*

*i.e. formic acid, methanamide, HCN

Long-term hydrothermal stability

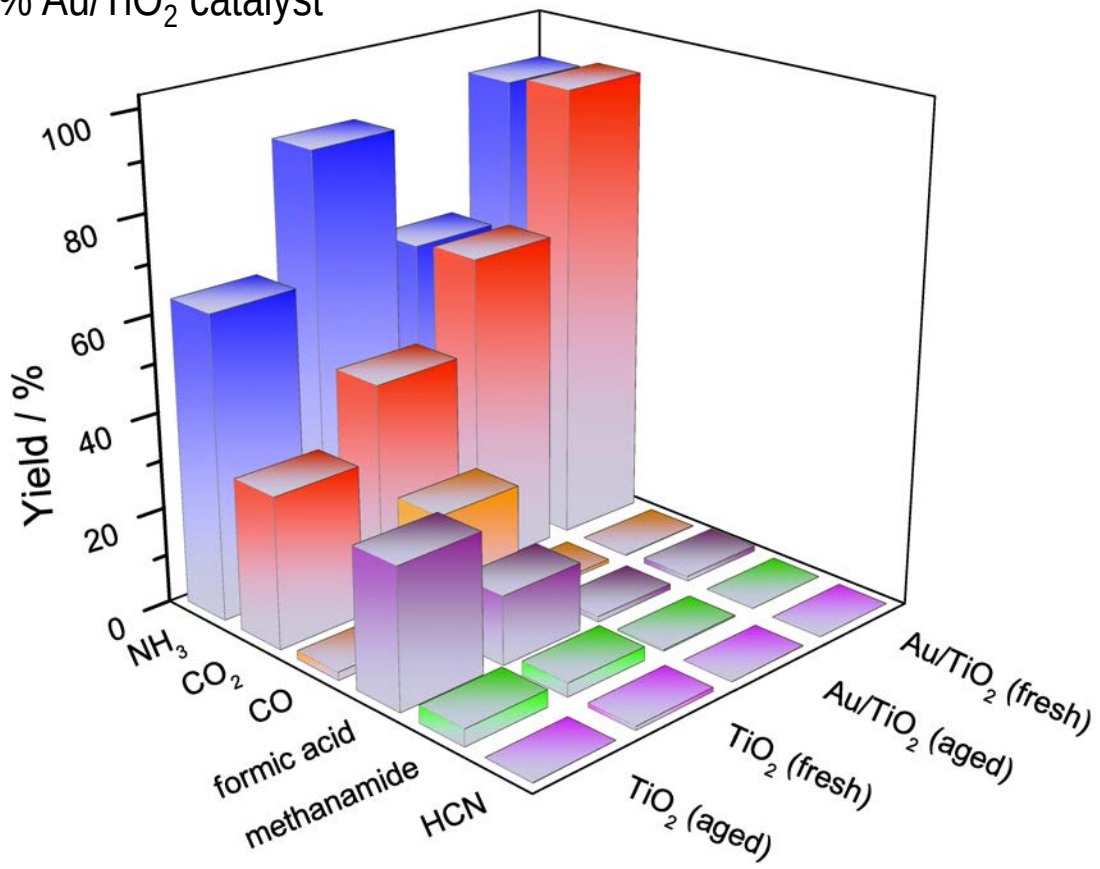
Experiments at 250°C with commercial catalyst or fresh and aged catalyst



➔ unprecedented stable conversion on an Au-doped catalyst

Influence of hydrothermal treatment

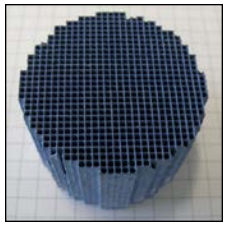
Experiments at 230°C with fresh and (double) aged commercial catalyst or fresh and (double) aged 1.5% Au/TiO_2 catalyst



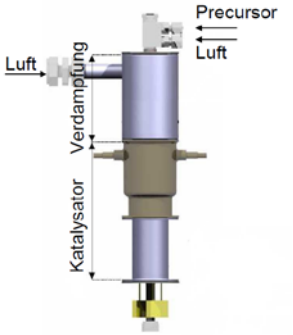
➔ side products surpressed, only aging of TiO_2 support decreases NH_3 yields

Conclusion

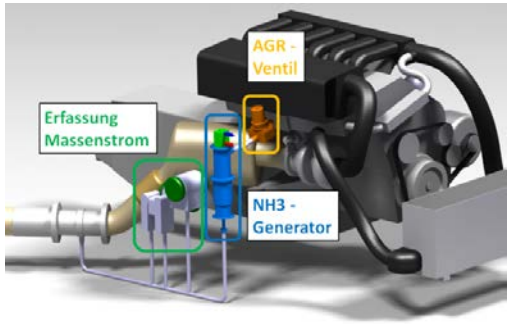
- Development of new Au/TiO_2 catalyst at PSI led to the development of a commercial prototype for exhaust gas aftertreatment in offroad Diesel vehicles



PSI lab catalyst



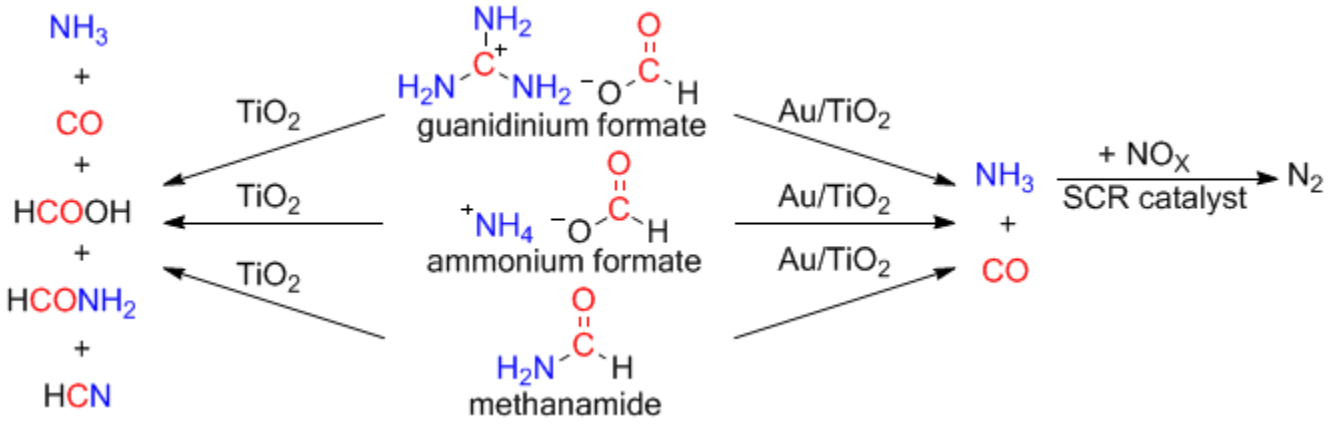
TU Munich prototype



TU Munich prototype testing

Commercial prototype for offroad Diesel vehicles

- Further research revealed not only guanidinium formate, but an entire class of compounds previously unacceptable for mobile exhaust control can now be used



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Thank you for your attention!