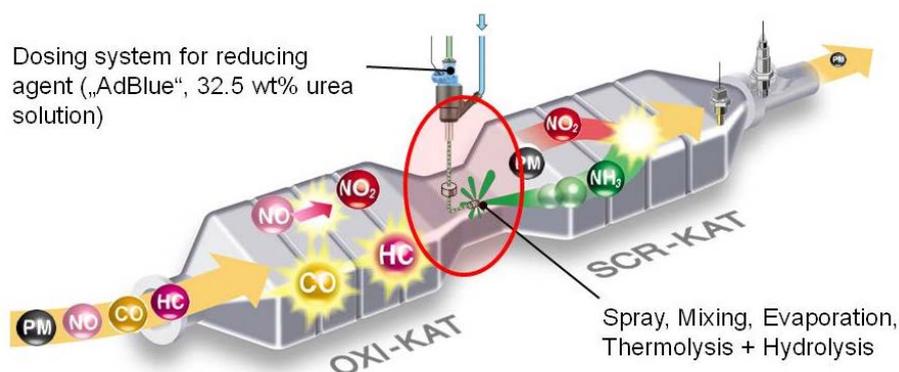


## Urea-SCR of NO<sub>x</sub>: Hydrolysis of urea and formation of by-products

**Background:** Due to legal regulations concerning the content of NO<sub>x</sub> in exhaust gases that continuously grow stricter, the necessity for conversion of these gases to nitrogen continuously becomes more important. A well-established technology for the reduction of NO<sub>x</sub> is the selective catalytic reduction using NH<sub>3</sub> as a reducing agent. For automotive applications, however, it is not advisable to have NH<sub>3</sub> onboard due to its toxic properties. The actually favored solution of this problem is the use of aqueous solutions of urea injected into the exhaust stream. At least at temperatures of the exhaust gas exceeding 130 °C the water evaporates, giving rise to the hydrolysis of urea, thus releasing ammonia which then can be catalytically converted with the NO<sub>x</sub> from the exhaust gas to nitrogen and water.



Abatement of nitric oxide emissions by urea-SCR (picture from Robert Bosch GmbH)

**Project:** Our research on urea-SCR is focused on studies concerning the evaporation of the water during heating up of the solution droplet, on the formation of solid by-products from the molten urea and on the mechanism of the formation of solid by-products and of the hydrolysis reaction leading to the release of ammonia. In contrast to the SCR-reaction, there are no detailed mechanisms based on elementary reactions for the hydrolysis of urea or for the reactions leading to the decomposition of urea to ammonia and isocyanic acid; it goes without saying that the reactions leading to heavier by-products such as biuret are even less understood. This situation leads to problems arising from non-uniform distributions of the spray on the SCR-catalyst and the formation of crusts of the solid by-products of urea pyrolysis. Our approach include experimental studies concerning the evaporation of water, thermolysis and the catalyzed hydrolysis of urea with the end of identifying reaction pathways and the implementation of the kinetics of these global reactions into a computer code for the simulation of reacting flows. As soon as available, the global reactions are to be replaced by mechanisms based on elementary reactions.

**Co-workers:** Wolfgang Brack, Steffen Tischer, Günter Schoch

**Collaboration:** Matthias Olzmann (Institute for Physical Chemistry)

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