



Urea Water Solution Dosing Ready for Future Legislation



Dr.-Ing. Robert Bank | robert.bank@fvtr.de | www.fvtr.de

BACKGROUND AND BOUNDARY CONDITIONS

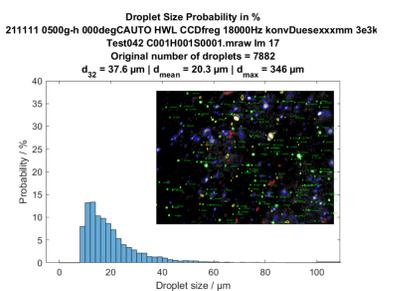
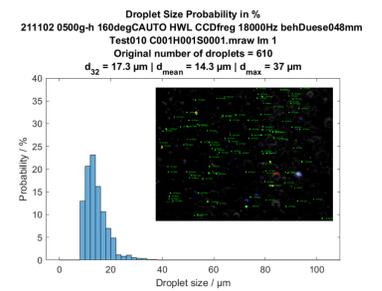
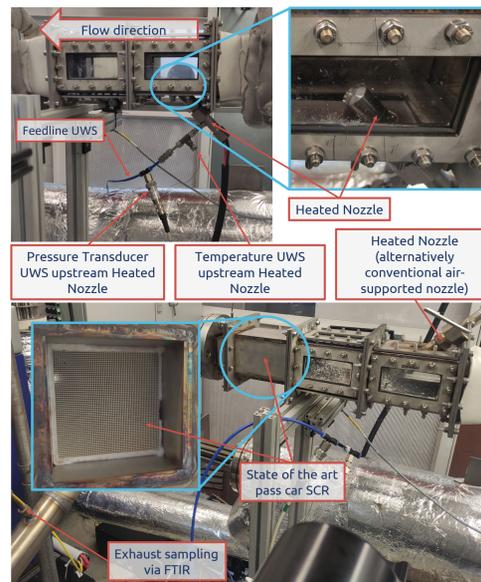
Exhaust gas legislation is becoming more stringent in all areas where internal combustion engines are used. This requires not only a deep understanding of the processes in the exhaust tract, but also the development of novel and clever technologies. FVTR supports Albonair GmbH in pushing the development of a **heated AdBlue dosing unit**. In addition to the applicator's courage to lower temperature thresholds, evaporation of the water portion of the urea-water solution and preconditioning of the urea before injection into the exhaust tract help to make optimum use of the energy available in the still cold exhaust gas for the chemical processes. In this case, FVTR's support includes both an experimental and a numerical component to achieve the best possible results.

EXPERIMENTAL SETUP

An optically accessible hot gas test rig was designed. Purified compressed air is adjusted and conditioned via heating registers.

The **heated nozzle** and a conventional, air-supported series as reference are analyzed by means of a high-speed camera as macro (spray image in general, spray angle, droplet formation and other effects) and with a far-field microscope in the μm range (in particular, droplet sizes and their distribution).

An extended setup with SCR catalyst and a NO metering section as well as the integration of an exhaust gas analysis (FTIR) allow the investigation of NH_3 formation and DeNOx performance.

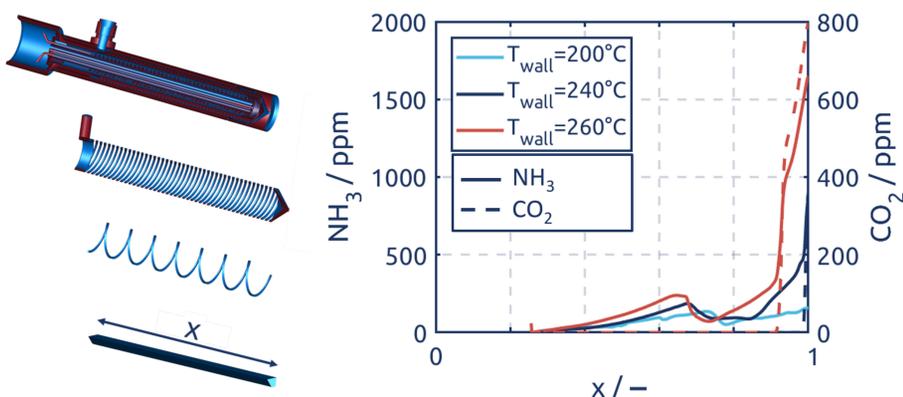


NUMERICAL SETUP

To analyze nozzle internal phenomena a **3D-CFD model** was developed. Basic features considered:

- **Eulerian Multiphase Approach**
- Urea decomposition, water flashing and gas phase reactions to model nozzle internal **thermolysis** and **hydrolysis**

Variations of boundary conditions (e.g. nozzle heating power, wall temperatures) show significant effects on NH_3 and CO_2 production as result of thermolysis and hydrolysis effects (see figure).



ALBONAIR

Albonair's mission is to make air cleaner – with innovative exhaust aftertreatment systems. The company has specialized in the development and manufacturing of urea dosing as well as thermal management systems for lowest NO_x emissions. Albonair systems offer commercial vehicle OEMs and engine manufacturers in the on-road and off-road sector an innovative and cost-effective solution to fulfill future emission standards. As a volume producer with more than 2 million systems in the market, Albonair is a well established and proven original equipment manufacturer worldwide. Albonair is a member of the multinational Hinduja Group and has in addition to its headquarters in Dortmund further branch offices and production plants in Chennai (India) and Shanghai (China).



KEY FACTS

The heated nozzle works! Complete evaporation of the water content is possible without risking operational malfunctions. The slightly different droplet spectrum (which only contains urea and no water) also contains a notable proportion of gaseous ammonia, thus pushing DeNOx performance!

