Poster Abstract:

Improving Heated Dilution Systems for Nanoparticles

Institute for Aerosol and Sensor Technology
Fachhochschule Nordwestschweiz

Corey Houle (corey.houle@fhnw.ch)
Heinz Burtscher (heinz.burtscher@fhnw.ch)

Over the past two years we have been working on improving and developing new heated dilution systems for exhaust gas measurements of nanoparticles. This work has been partly in cooperation with Matter Engineering and has contributed to the development of their newest rotating disk diluter with an extended operating lifetime. A significant effort has been spent searching for new materials with optimal tribological properties for this application as well as developing the manufacturing techniques required to maximize their performance. Solutions aimed at extending the operating lifetime of the rotating disk diluter using both high temperature plastics and precision ceramic components have been produced and tested.

Building on this experience, two prototypes were designed and constructed. The first system, based on the well known revolver diluter concept, utilizes a high performance polymer, optimized for tribological applications for the rotating disk. The second is a novel concept, which uses stock seals and small piston to transfer exhaust gas to the measurement channel in precise doses, allowing the dilution ratio to be accurately specified.

This second concept, entitled the "Reciprocating Diluter" was tested extensively for sealing, performance and reliability with excellent results. Dilution Ratio's were shown to change linearly with reciprocation frequency from 100:1 until 15:1 with flow rates of 1.5LPM. Based on our experience, this range represents the most important set of dilution ratio's for measuring combustion gases. The seals selected are also excellent at withstanding high temperatures, pressure differences between the flow channels and chemical attack from exhaust gas constituents.

This poster documents the path from the initial problems through to the prototypes and their initial testing via three investigation paths: Plastics, Ceramics and Stock Seals. The intent is to give the reader a highly visual narrative of the development process focusing on the experiments, simulations and mechanical design employed along the way.