Long-term Performance of a Fuel Vapor Retention System (FVRS) while using Bioethanol as a Fuel Additive

Since 2011 gasoline passenger car engines are fueled with E10. This biofuel contains between five and ten percent of bioethanol. The aim of adding bioethanol is to reduce the consumption of fossil fuels and CO_2-emissions. As with other types of fuels, about 11 kg of volatile hydrocarbons (VOCs) per year escape from the tanks of cars with gasoline engines into the environment. To avoid these issues, the use of so-called „fuel vapor restraint systems (FVRS)“ is already state of the art since a few decades (see Fig. 1).

term operability of these filters when using biofuel is still an open question.

In a new research project researchers of the University of Siegen (TTS) and the Fraunhofer Institute for Environmental, Safety and Energy Technology (UMSICHT) in Oberhausen analyze now the operability of these filter systems under long term close-to-reality conditions, which are loaded with different bioethanol-blended fuel vapors such as E10. In order to investigate the long term behavior of such filter systems, it is impor-

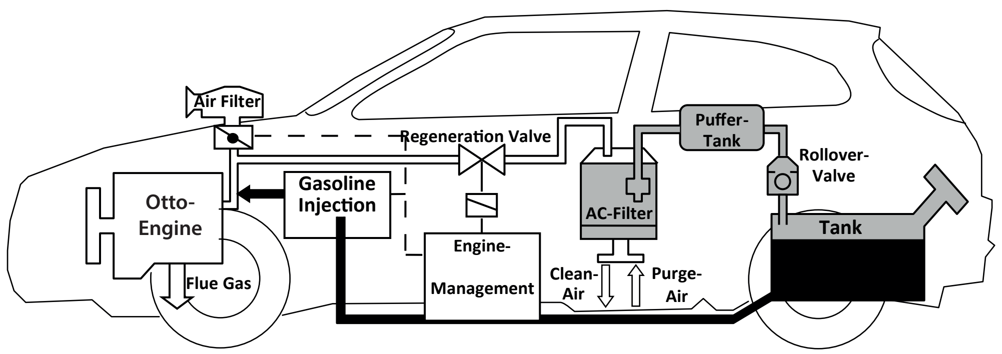

Figure 1: Schematic sketch of a fuel vapor retention system (FVRS).

A FVRS consists essentially of a plastic container filled with activated carbon where the fuel vapors (VOCs) in the pores of the activated carbons (AC) are adsorbed. If the AC filter is almost fully loaded it is regenerated usually with humid ambient air, since the humid air is able to desorb petrol vapors (VOCs) from the AC. The scavenging air enriched with VOCs is then sucked into the engine and is burned there. Nevertheless the long

tant to monitor the exact composition of the gas leaving the filter.

Therefore based on the basic principle of spontaneous RAMAN scattering a sensor system is developed to monitor time resolved the composition of the gas leaving the filter system during long term operation. Spontaneous RAMAN scattering occurs when a gas sample is irradiated with monochromatic light due

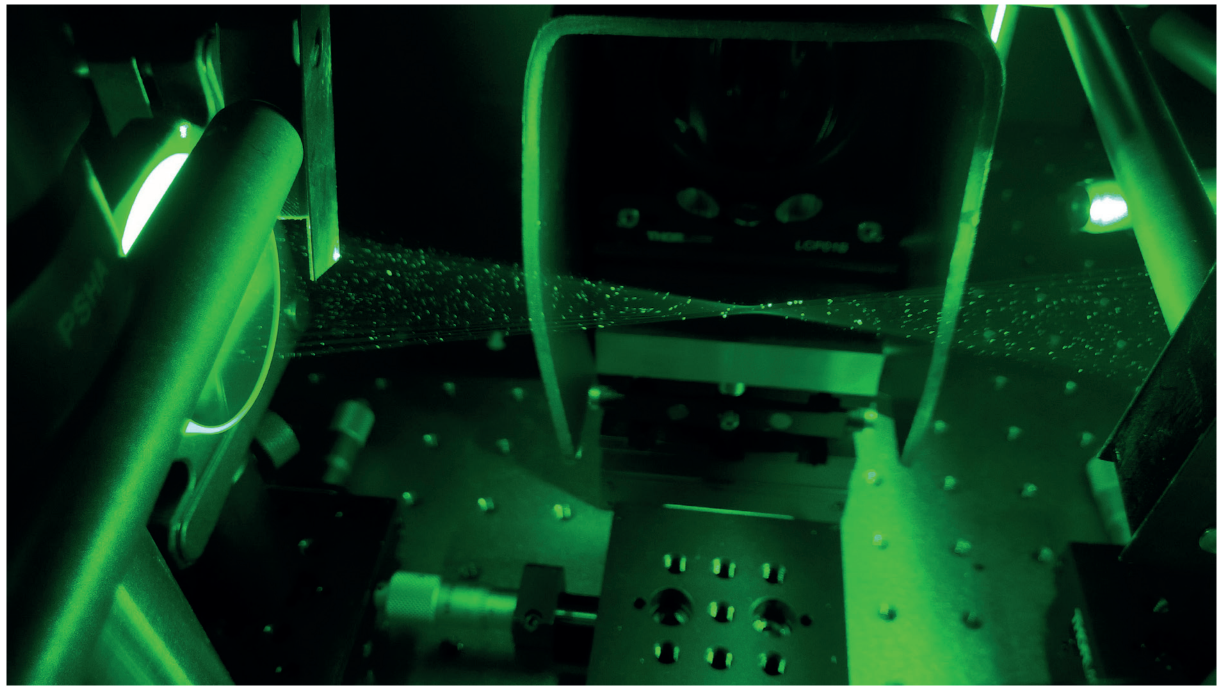

Figure 2:
Raman measurements with a multi-pass arrangement for signal amplification.

to an energetic interaction between light and the gas molecules. The spontaneous Raman scattering technique is an excellent tool for a quantitative analysis of multi-species gas mixtures since it allows the simultaneous detection of virtually all polyatomic species with high temporal resolution with one sensor system. It is a noninvasive optical method for species identification and gas phase concentration measurement of Raman active molecules, since the intensity of the molecule specific Raman signal is linearly dependent on the concentration. The Raman sensor essentially consists of a laser, a measurement cell with four optical windows, a spectrometer and a detector. For an optimal signal yield a multi-pass cavity is realized. This setup is shown in figure 2. This sensor system is combined with the test facilities at the Fraunhofer Institute (UMSICHT) for the above mentioned long term test of the FVRS.

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Acknowledgement:
This project is supported by the German Federal Ministry of Food and Agriculture (BMEL) and coordinated by the FNR (Fachagentur Nachwachsende Rohstoffe e.V.) project grants No 22403115.