



LOW-EMISSION ETHANOL FIREPLACES

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Ethanol fireplaces are popular because they can generally be operated in private households without a chimney or other exhaust systems. They also require little space and are quite inexpensive. Since ethanol fireplaces currently do not have an integrated exhaust gas purification system, users are directly exposed to the pollutants emitted, such as benzene, formaldehyde, carbon monoxide and nitrogen oxides. This can potentially cause health problems. Within the project “Clean EtOH-fire” (development of an emission-minimized combustion system for [bio-]ethanol), a system for the pollutant-free and operationally safe combustion of ethanol was developed together with industrial partners. This system can be used not only in households or by the commercial sector (restaurants, hotels and events), but also as a supplementary CO₂-neutral chimney heating system in low-energy houses.

Fraunhofer IKTS has developed a catalyst concept for this purpose, based on its extensive know-how in the field of engine and industrial exhaust gas purification. On the one hand, this enables reducing pollutants at very low reaction temperatures and, on the other hand, optimal flow distribution of the reaction gases within the catalyst support. Furthermore, it does not require any additional auxiliary energy and has a long service life. The catalyst support is based on open cellular ceramic foams, which boast a much lower back pressure than catalyst beds. At the same time, the network-like structure allows for long residence times of the pollutants on the catalyst, which is a major advantage over catalyst honeycombs. Open-cell foam ceramics are produced by replication of reticulated polymer foams using the so-called Schwartzwalder process.

The catalysts are adapted to the special operating conditions of ethanol burners and the catalyst support in order to achieve high conversion rates under the given temperature and exhaust gas conditions. This includes the synthesis and functionalization of the catalyst materials as well as their processing to achieve suspensions with which homogeneous and crack-free layers can be realized on the catalyst support. As a result, hydrocarbon and CO emissions can be reduced simultaneously when the exhaust gas comes into contact with the catalyst.

Services offered

- Development of suitable catalyst supports made of cellular ceramics
- Synthesis of catalysts and process development for catalytic coating
- Laboratory tests on the application properties of coated substrates and evaluation of the catalytic behavior and long-term stability

1 Conventional ethanol fireplace without exhaust gas purification system (© pixabay | Antoine Belverge).

2 Catalyst support made of cordierite foam ceramics with catalytic coating.

