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## CATALYTICALLY FUNCTIONALIZED FILTERS FOR SMALL WOOD-BURNING APPLIANCES

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Wood and solid fuel heating plays a pivotal role in the transition to renewable energy and has become established as a low-cost, environmentally friendly alternative to oil and gas heating. The second phase of the first Federal Emission Control Act (BImSchV), in force in Germany since January 1, 2015, prescribes maximum permissible emissions for domestic wood-fired appliances (wood stoves and masonry heaters) of 40 mg/m<sup>3</sup> particulate matter and 1250 mg/m<sup>3</sup> carbon monoxide. State-of-the-art wood stoves with "ECOplus" combustion technology developed through a partnership between Hark Kamin- und Kachelofenbau GmbH & Co. KG in Duisburg, the Fraunhofer Institute for Building Physics IBP in Stuttgart, and Fraunhofer IKTS in Dresden meet these requirements. At the heart of this system is a ceramic foam filter that optimizes combustion and reduces particulate emissions. Catalysts adapted to the specific operating conditions of the wood-burning appliance can be additionally used to minimize emission of gaseous pollutants, such as hydrocarbons (HC) and carbon monoxide (CO). The temperature conditions in the wood-burning appliance during operation strongly affect catalytic activity and aging resistance.

In a subsequent research project conducted with Hark, the potential of using catalyzed filters to improve the environmental friendliness of wood-burning appliances was investigated in wood-fired stoves. Based on the temperature and emission characteristics found in investigations to be valid under typical application conditions, suitable catalysts were identified and selected for the development of catalyzed ceramic foam filters with efficient reduction of CO and HC emissions. The catalyst efficiency was investigated in the laboratory and, with the assistance of Fraunhofer IBP, in real operating conditions in

wood-burning appliances. The high catalytic activity remained nearly unchanged in long-term aging tests under rated load and alternating load conditions as well as with use of non-compliant fuels. In addition, no wear or decrease in efficiency of the catalyzed filters has been found in application tests performed to date. Field tests are currently underway to lay the groundwork for market introduction of the catalyzed filters; the corresponding mass production processes have already been developed.

### Services offered

- Development of ceramic deep-bed filters and ceramic-supported catalysts for exhaust treatment
- Production and analysis of test samples and at small scale

1 *ECOplus wood stove by HARK*  
(Source: HARK GmbH & Co. KG).

2 *Filter with integrated catalyst "ECOplusKAT"*  
(Source: HARK GmbH & Co. KG).