

# Reduction of soot particles and hydrocarbon emissions from small scale furnaces

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## Problem

- Wood is becoming increasingly important as a renewable fuel for generating heat in private households. Approximately 14 million small-scale furnaces have already been installed in Germany. Especially those with less than 15 kW of power are known to emit substantial quantities of pollutants.
- In addition to dust particles and the toxic gas carbon monoxide, these wood furnaces also emit large quantities of gaseous hydrocarbons that have not only been classified as carcinogenic but also have very unpleasant odour.
- Especially the high PM10 concentrations in the dust emissions require an urgent need for action.



## Exhaust from small scale furnaces

**Hydrocarbon content:**  
4000 mg/m<sup>3</sup> (90 - 8000 mg/m<sup>3</sup>)

**Dust content:**  
Approx. 130 mg/m<sup>3</sup> (50 - 450 mg/m<sup>3</sup>)  
(therefrom about 100 mg C/m<sup>3</sup>)

**Particle size:**  
Up to 95 % of the dust in the exhaust gas of small scale furnaces are smaller than PM10

Around 90 % of all dust particles from domestic heating are emitted by wood-fired furnaces.

## Solution

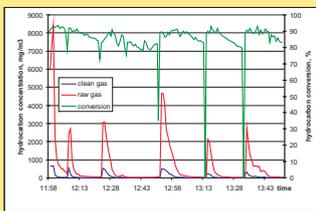
The Institute of Energy and Environmental Technology (IUTA) has developed a catalyst system for small-scale wood-fired furnaces with which it is possible to significantly reduce gaseous hydrocarbons and Carbon monoxide as well as the soot content in the exhaust gas.

The emission control system is mounted directly behind the furnace in the flue pipe. It consists of a lens-shaped cartouche filled with approx. 600g high-grade steel chippings, which are coated with palladium, the active component of the catalyst. A special dedusting unit consisting of a stainless steel lattice welded on a copper ring is mounted in the center of the catalyst material. The device operates according to the Seebeck effect: in response of a temperature gradient two dissimilar materials generate an electromotive force, causing the flow of current. The generated current respectively the induced electrical and/or magnetic fields lead to the collection of the soot particles, which are subsequently oxidized.

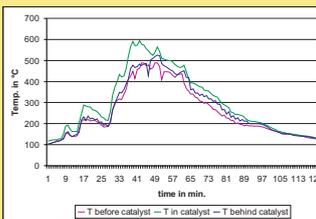
## Oxidation of hydrocarbons with the Pd-chipping catalyst



Pd-chipping catalyst    Cartouche assembly



Hydrocarbon conversion



Temperature profile in the fluegas



Emission control system for small scale furnaces

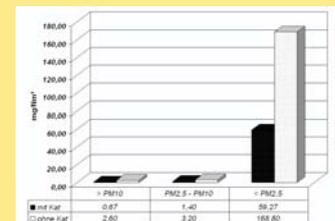
## Collection and conversion of soot particles with the dedusting lattice



Dedusting and conversion lattice    Soot collection

No.	raw gas mg/m <sup>3</sup>	dust concentration		separation rate in %	
		clean gas mg/m <sup>3</sup>	in %		
1	1140	182	84	soot	
2	10950	612	94	soot	
3	191	29	85	soot	
4	177	55	69	soot	
5	402	152	62	mineral dust collection	

results obtained by recent measurements



Cascade impactor data of the dust