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INVESTIGATION OF POTENTIAL IMPACTS ON THE ENVIRONMENT DURING COMBUSTION OF NANOMATERIAL CONTAINING WASTE

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INTRODUCTION

Nanomaterials are used in various fields of consumer products. It must be assumed that nanomaterials are reaching in an increasing extent the domestic waste incineration. So far there is little-known how engineered nanomaterials behave during waste combustion and whether exposures are expected in the environment. With experiments in a pilot plant combustion units and measurements in one waste incineration plant the entire route from the waste via incineration, flue gas treatment to a possible release to the environment is considered.

OBJECTIVE

The experiments should identify and quantify the distribution paths of the studied nanomaterials in residues as well as in the flue gas in combustion units.

METHODOLOGY

Model substance for all experiments:

- Nanoparticular titanium dioxide (primary particle size of about 10 nm)
- High usage in consumer products, inert and high melting point (1800 °C)

Particle analysis:

- Collecting particles: 13 staged low pressure cascade impactor
- Titanium content analysis: ICP-MS
- Structure analysis: SEM/EDX

Achieving objective in two steps:

- Experiments in a pilot plant combustion unit (100 $kW_{thermal}$)
- Measurement campaign in a waste incineration plant

RESULTS OF THE PILOT SCALE

- Fixing of the nanomaterial in and on the fuel has a limited influence on the release during the combustion process
- Titanium dioxid in the flue gas was mainly detected in the particle sizes over 300 nm

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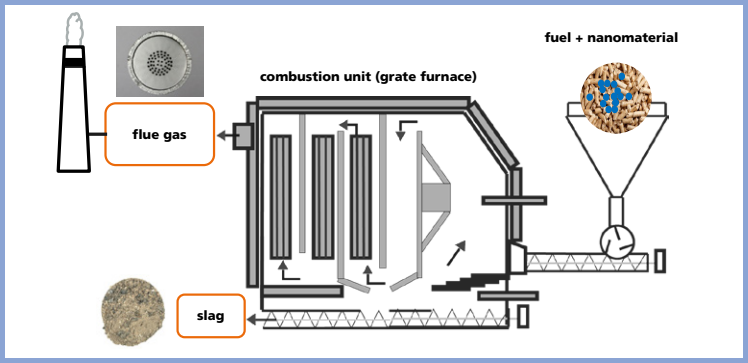
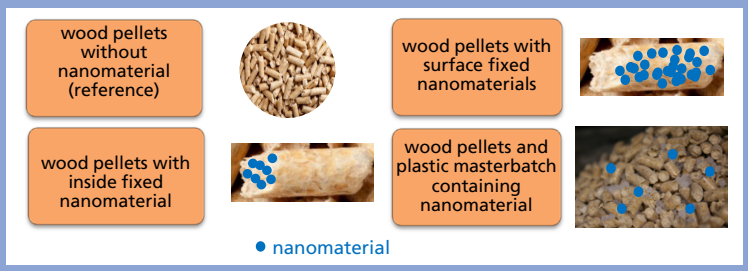
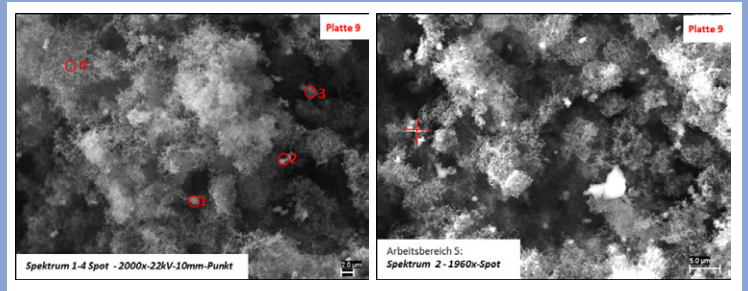


Scheme of the pilot scale combustion unit with sampling points



Various application forms of nanomaterials on fuel



Spektrum	C	O	Na	Si	P	S	Cl	K	Ca	Ti
Punkt 1	86,45	8,64	0,15	0,38	0,01	0,02	0,13	0,07	0,01	**2,58**
Punkt 2	85,76	8,15	0,11	0,40	0,01	0,03	0,15	0,10	0,01	**1,23**
Punkt 3	82,83	10,67	0,14	0,41	0,02	0,03	0,14	0,09	0,02	**2,02**
Punkt 4	90,34	5,78	0,10	0,34	0,01	0,02	0,11	0,06	0,01	**0,31**

SEM-picture of flue gas particles (1,6 – 2,3 µm) and element results (EDX)