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Method for the characterization of nanoparticle release from surface coatings

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Surface coatings are widely used in industry as well as domestically. Nanoparticles are considered to enhance substantially certain properties of such coatings, e.g. its resistance to mechanical stress or UV-light. Thus they are increasingly employed as additives. The usage of these coatings is subject to investigations regarding the release of nanoparticles into air, which may cause adverse health effects / have an impact on human health. However, suitable methods for the quantification of nanoparticle release have not been established yet.

Investigations in the field of wear resistance were normally made in the area of material science either in dry and in wet environments. One of the most common tests for simulating the abrasive damage during the service life of components is the so called Taber test (see Figure 1).

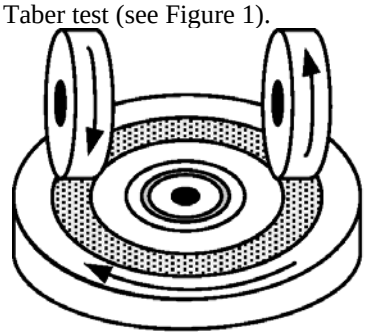

Figure 1. Abrasion scheme of a Taber Abraser with test piece (sample), abraded area, abrasion wheels and the direction of rotation (marked with arrows)

The stress of the Taber test corresponds to the typical stress applied to surface coatings in a domestic scenario, e.g. when walking with sandy shoes on a floor surface coating. With this method an area of 30 cm^2 per revolution is stressed with both wheels. The parameters which have to be specified for the testing method are the material of the abrasion wheels, the normal force and the number of abrasive cycles (number of turntable revolutions).

The Taber test ensures a reproducible and standardized stress of the sample which is important for reproducible measurement results.

The employed test rig bases on an abrasion section and a measurement section. The released particle concentration of the aerosol, generated by the Taber Abraser, is determined by CPC. Also the particle size distribution of the aerosol is measured by SMPS. An Electrostatic Precipitator (ESP) is used for deposition of nanoparticles for subsequent microscopic analysis. The mass loss resulting of the abrasion process is determined gravimetrically.

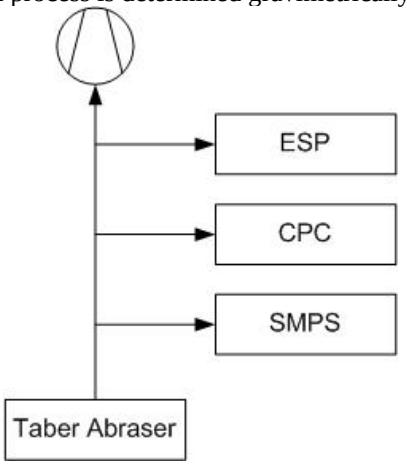

Figure 2. Schematic test rig with aerosol generation (Taber Abraser) and measurement setup (CPC, SMPS and ESP).

In preliminary tests the optimal adjustments of the abrasion tool were determined.

The measured data delivers the mass loss of the sample and the size distribution of the released particles. This enables the specification of the number concentration of the released particles in defined size fractions (< 100 nm, < 625 nm and total) per mass unit of the coating material.

The contribution will explain the developed method in detail and present first data for different coating types. More information are given in Vorbau *et al.*, 2008.

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