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Analysis report 884035

Coating Test in a Ventilation Duct

Danish Technological Institute

Title:
Coating Test in a Ventilation Duct

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1. Assignment

E-AT ApS has requested Danish Technological Institute to measure potential release of particles and VOC's from a coating inside a ventilation duct.

The tested coating is of the type SC50, which prevents corrosion in ventilation systems and serves as fire protection.

The purpose of the measurements is to investigate whether particles and VOC's are released from the coating into the environment when operating ventilation systems.

The current measurements were performed in a test set-up at the Danish Technological Institute in Taastrup, where a number of other tests have been carried out. These results from these tests are not included in this report.

The measurements were made on November 6, 2019.

2. Conclusion

Particles
There were no difference in the particle number concentrations measured in the background laboratory air and measurements performed inside the coated ventilation duct at 3 m/s and 12 m/s, respectively. Particle size distribution (range 10 nm -10.0 µm) did not change between the three measurements. Based on these measurements we conclude that no particles within the measured range were released from the coating and distribution to the surrounding environment.

Volatile Organic Compounds (VOC)
The VOC concentration inside the coated duct was measured to a concentration of 680 µg/m^3. The VOC concentration in the background laboratory air was measured to a concentration of 230 µg/m^3.

The higher VOC concentration was caused by a single chemical compound called 2-Propanol,1-(2-butoxy-1-methylethoxy)- with a concentration of 470 µg/m^3 inside the coated duct and 51 µg/m^3 in background air, respectively. The specific compound is not considered hazardous in the measured concentrations and it is commonly used in similar coating applications.

In Denmark there is no limit value for VOC in indoor Air, but according to German Authorities[1] concentrations below 300 µg/m^3 TVOC (Total Volatile Organic Compounds) belongs to the best category of indoor air quality, provided that there are no single components that may pose a health risk. In general, TVOC concentrations should not exceed concentrations of 1.000 - 1.300 µg/m^3 in normal room with longer-time residence. This also means that the measurements were performed in an appropriate environment with respect to the VOC level.

[1] Health and Environmental Hygiene, Guide values for indoor air quality, 2015. https://www.umweltbundesamt.de/en/topics/health/commissions-working-groups/german-committee-on-indoor-guide-values#textpart-3

3. Measurement Procedure and Analysis Methods

Particle measurements were carried out in the Ø160 duct with a flow velocity of 3 m/s and 12 m/s over a period of 2 hours. VOC measurements was only performed during a flow velocity of 3 m/s. A sketch of the experimental setup are shown in Figure 1. Pictures from the test setup can be found in the appendix.

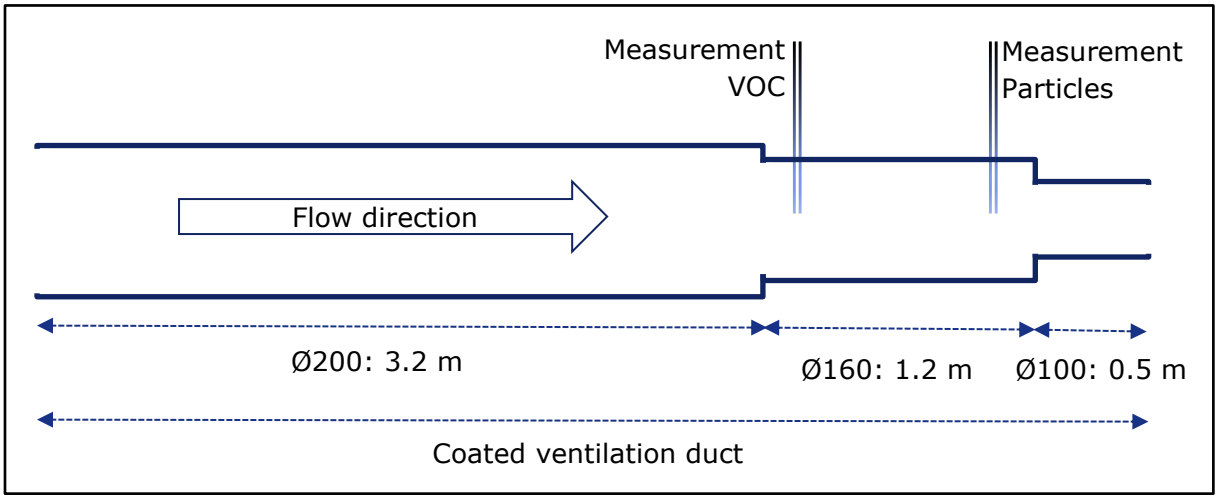

Figure 1. Sketch of experimental set up.

3.1. Particle Measurements

Two instruments were used for these measurements, which together can measure both particle number concentration and size distribution in the particle size range 10 nm - 10 µm.

The smallest particles were measured with a Scanning Mobility Particle Sizer (NanoScan SMPS), model 3910 from TSI. The instrument measures particle number concentration in a fixed size range from 10 nm to 420 nm with a time resolution of 1 minute and divided into 13 size fractions.

The larger particles were measured with an Optical Particle Sizer (OPS), model 3330 from TSI. The instrument measures particle number concentration in a fixed size range from 0.3 µm to 10 µm with a time resolution of 1 second and divided into 16 size fractions.

The particle measurement was carried out in an isokinetic way. The particle number concentration is reported as an average mean value for each instrument based on 10 consecutive samples. Data from both instruments were combined in order to calculate a particle size distribution from 10 nm - 10 µm.

A background measurement was performed in the inlet air from the laboratory in connection with the measurements.

3.2. Volatile Organic Compounds (VOC)

The collection of VOC was performed using ATD tubes (Tenax sorbent) and subsequent analysis with GC/MS. The collection was made over 1 hour using GilAir calibrated pumps at a flowrate of 100 mL/min. The analysis included a screening of the 20 most dominant VOC.

According to agreement with E-AT, measurements were only made inside the ventilation duct at 3 m/s. In order to compare with background VOC naturally occurring in the laboratory, an additional background collection was sampled in similar way.

4. Results

4.1. Particle Number Concentration

Average particle number concentrations are shown in Table 1 for the different experimental set up.

Measurement	NanoScan SMPS 10-420 nm (particles/cm^3)	OPS 0.3-10 µm (particles/cm^3)
Background	7.400 ± 100	5.2 ± 0.0
Velocity Ø160: 3 m/s	7.600 ± 400	5.8 ± 0.1
Velocity Ø160: 12 m/s	7.400 ± 200	5.3 ± 0.1

Table 1: Average particle number concentrations with a standard deviation.

The measurements indicated particle number concentrations at the same level for the two velocities. Both measurements inside the ventilation duct were similar to the background level performed in the laboratory.

4.2. Particle Size Distribution

The particle size distributions for the different measurements are shown in Figure 1. The distributions indicate that there are no significant differences in the particle size distributions at the 3 different measurements (background, 3 m/s and 12 m/s).

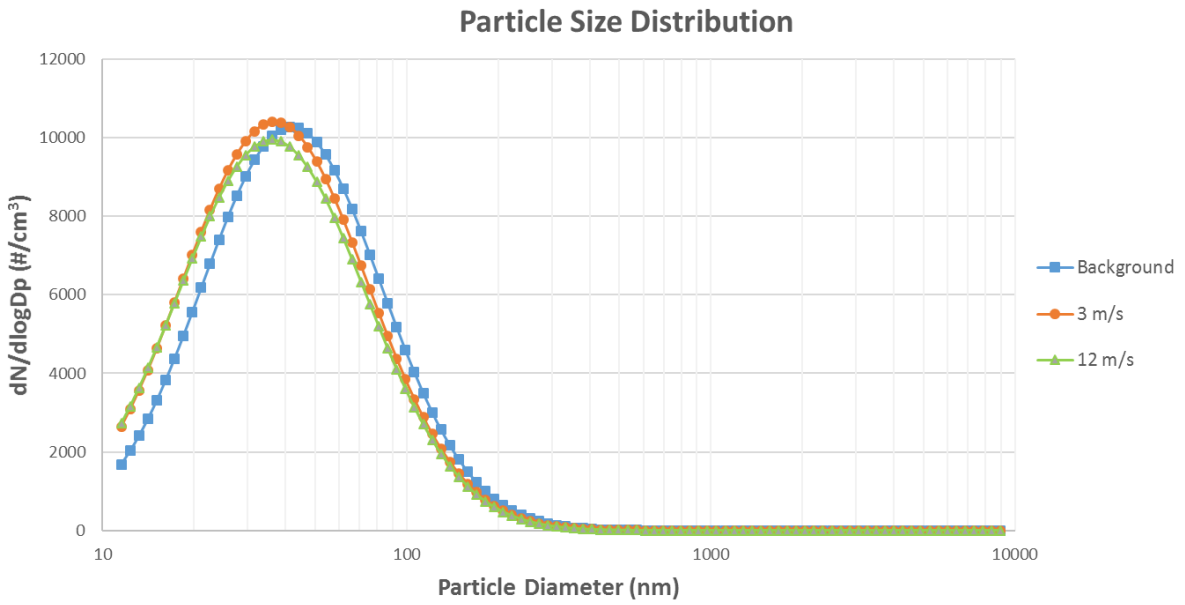

Figure 1: Particle size distribution from the different measurements. The x-axis is shown with a logarithmic scale.

4.3. Volatile Organic Compounds (VOC)

The summarised VOC concentration from the background and measurements inside the ventilation duct are shown in Table 2.

Measurement	Sum of VOC ($\mu g/m^3$)
Background	230
Velocity Ø160: 3 m/s	680

Table 2: VOC concentrations in the background air and in the coated ventilation duct.

The different between the two VOC measurements can be explained mainly from a single chemical compound called 2-Propanol,1-(2-butoxy-1-methylethoxy)- (CAS no. 29911-28-2). For this substance we measured a concentration of 470 $\mu g/m^3$ and 51 $\mu g/m^3$ in the ventilation duct and background, respectively. Since the concentration is around 10 times higher in the ventilation duct, we conclude that this component originates from the coating material. At the time of the analysis no information about the specific component of the coating has been provided from E-AT. The component is often used in similar coating products. The material is not considered harmful when exposed to in the measured concentrations range.

Except from this specific component there were no significant differences in the VOC concentration in the background and ventilation duct.

5. Appendix with Pictures of the Test Setup

Figure 2: Overview of the whole test setup.

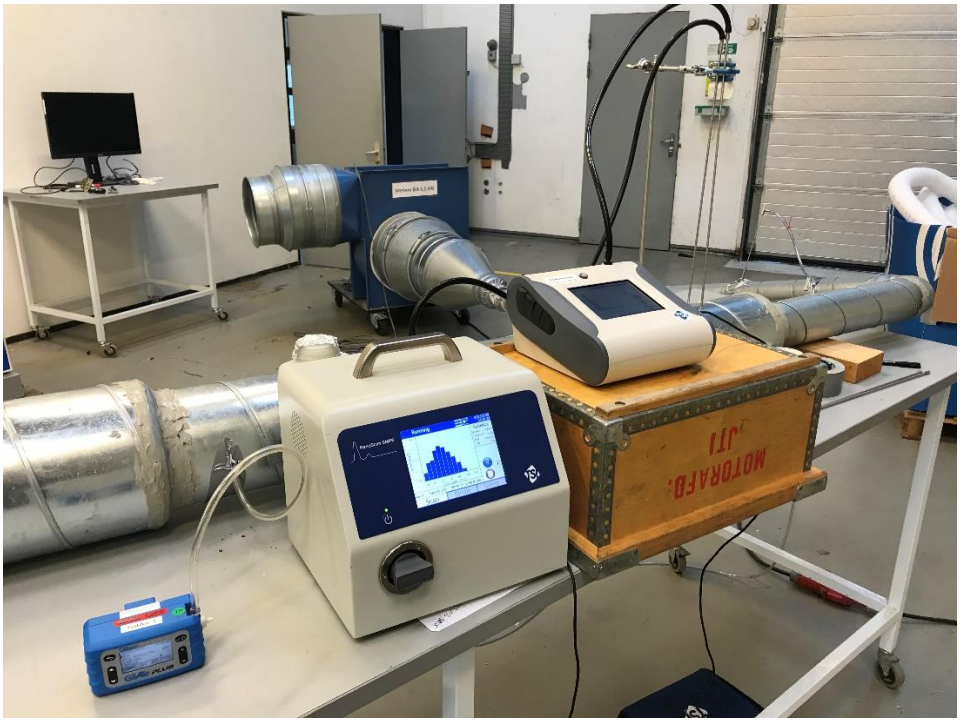

Figure 3: Measurements were performed in the Ø160 section with VOC to the left (most upstream) and the isokinetic sampling ports shown to the right (downstream).