Carbon Black vs Black Carbon

Application-oriented Analysis of Nanomaterials

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Unveiling structure

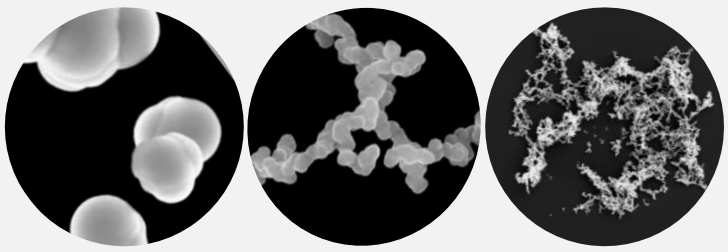
Carbon black (CB) is used as an additive and filler in tires, plastics and paint. A passenger car contains more than 10kg of carbon black.

To emit 10kg of black carbon a Euro-6 car has to drive 2.2 million km

Nanoparticle – named after a length, but traded in €/kg, grams, big bags, …

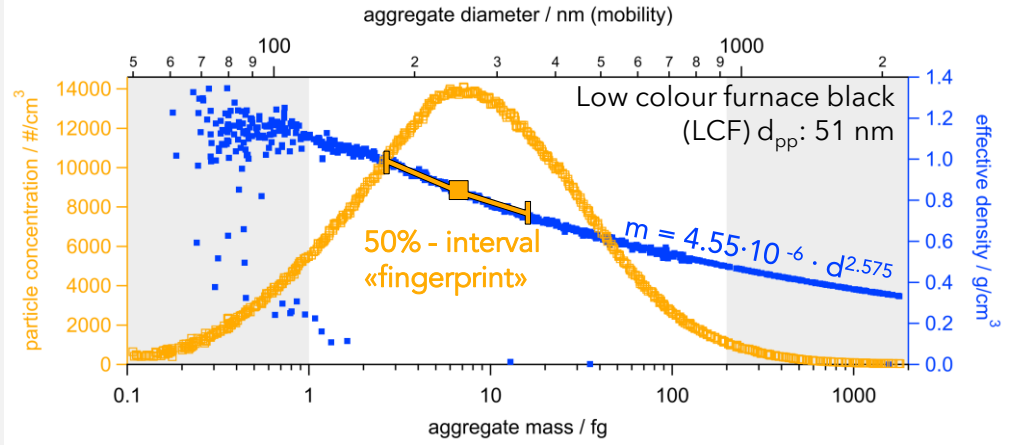
How many nanoparticles are in one gram of powder?

How long does it take to characterise the structural properties of these particles with electron microscopy?



A faster analysis of the CB properties can reduce the consumption of crude oil, the feedstock for the furnace black process

The simultanous analysis of particle mass and diameter can resolve the structure of engineered nanomaterials.
8-12 min per scan; 10-50 mio particles counted



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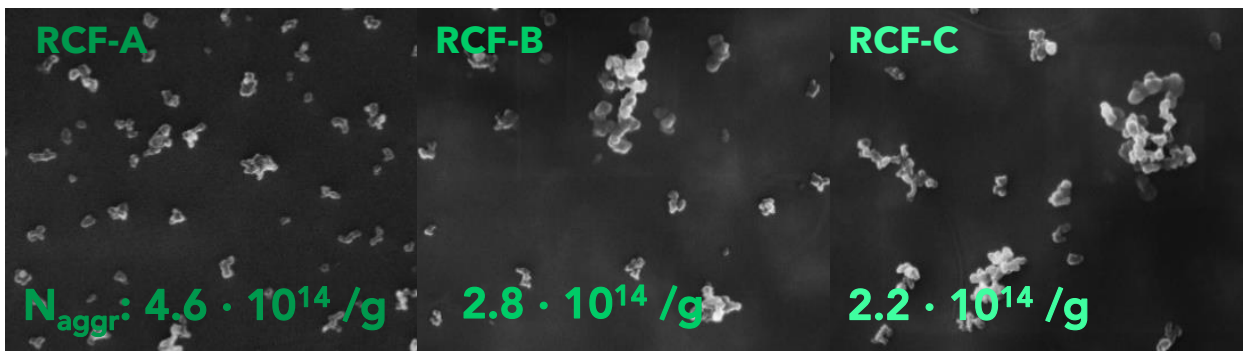
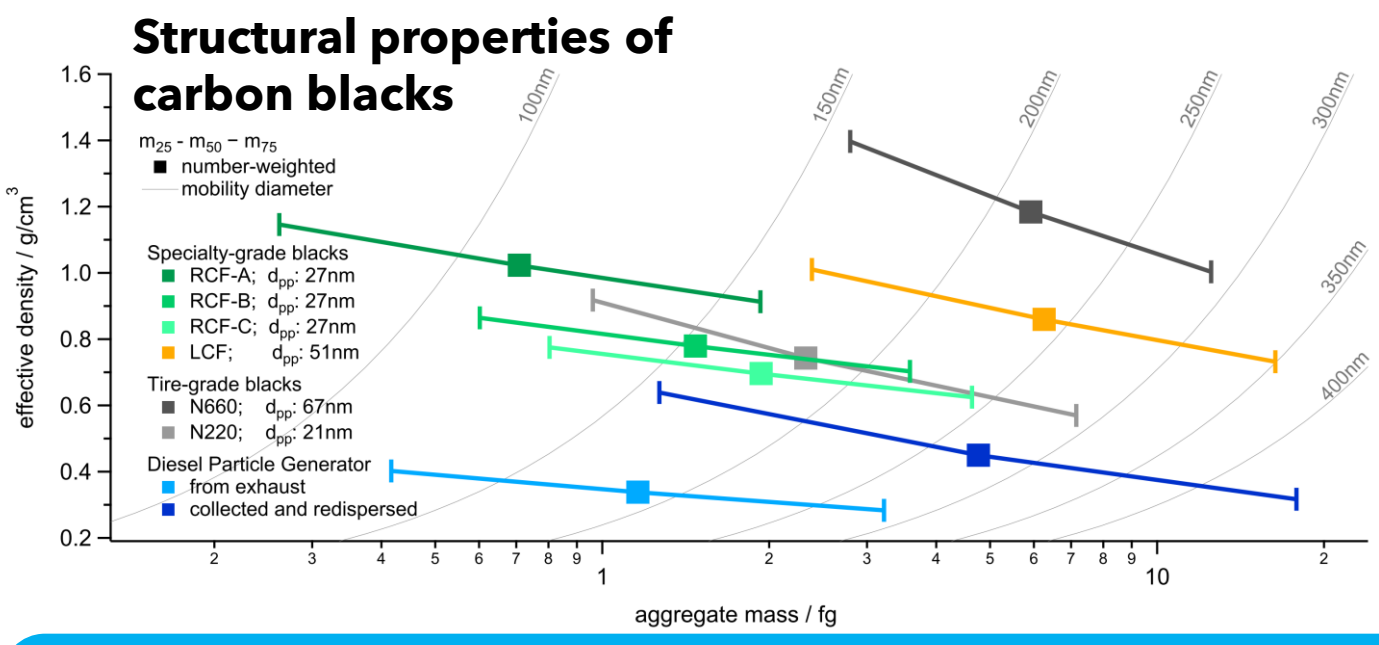
Window gaskets, bumpers, car paint and every other black item contains CB with different particle sizes and structures such as,
→ Regular colour furnace blacks (RCF)

An increasing aggregation level leads to heavier and larger particles, but the effective density and the number of particle per gram (N_{aggr}) decrease



Structural properties of carbon blacks



CB with small primary particles, high surface areas and an open-structured aggregates make rubber sturdy and abrasion-resistant. These properties are required for the thread of car tires
→ high-reinforcing CB grade **N220**

The side walls and inner liner of tires have to be softer and more shock-absorbing. For this CB with larger PPs and less branched aggregates is mixed with rubber
→ low-reinforcing CB-grade **N660**

Is carbon black a suitable proxy for engine soot? Why don't we use black carbon for tire production?

Apart from a much higher organic carbon content and different surface chemistry. 1) Soot from **diesel engines** has different structural properties than tire-grade CB. 2) Soot tends to be sticky. Once collected on a filter the original aggregate structure cannot be isolated by **redispersing engine soot**. No, we cannot exchange CB with BC!

1. Sampling

a) from reactor or exhaust

b) powder
- dry-dispersion
- wet-dispersion

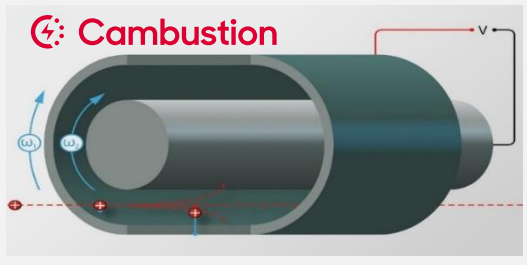
2. Deagglomeration

- venturi-nozzles
- ultrasound treatment
- adjustable deagglo-meration intensity

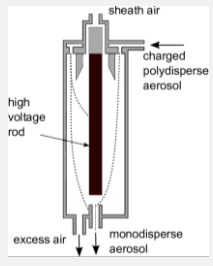
probing particle stability

3. Mass mobility aerosol spectrometer

1) mass to charge ratio



2) particle mobility



3) charge per particle

CPC + electrometer