Comparison of different soot generators: Towards a standard reference material for aerosol absorption

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This work is part of the EMPIR BC project, which aims to provide traceability to black carbon (BC) absorption measurements. The goal of this work was to investigate several candidate reference methods for use as BC source to generate fresh-like soot aerosol particles with the properties listed below:

- **PARTICLE DIAMETER (Dp)**: 50 - 100 nm
- **ABSORPTION ANGSTROM EXPONENT (AAC)**: ~1.0
- **SINGLE SCATTERING ALBEDO (SSA)**: 0.05 - 0.20

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**EXPERIMENTAL SETUP**

**SOOT AEROSOL GENERATORS**

- **COMBUSTION-BASED**
  - mini-CAST 5201BC
  - mini-CAST 5303C (x2)

- **SPARK-BASED**
  - FasmaTech spark generator

- **ATOMIZED AEROSOL**
  - Fullerene soot
  - Colloidal graphite

**OPTICAL PROPERTIES**

- **AAC** is calculated at 870 nm from PAX absorption measurements.
- **MAC** is calculated as the ratio of absorption (extinction minus scattering) at 630 nm to aerosol mass concentration from TEOM measurements.

**ÁNGSTROM COEFF. vs. SINGLE SCATTERING ALBEDO**

**CONCLUSIONS AND OUTLOOK**

- The combustion generators (all the mini-CAST and the miniature inverted soot generator) were able to provide BC aerosol particles with the desired SSA (~0.2).
- Among the combustion generators, the diffusion flame models (5203C and 5303C) produced particles with the largest AAC. In this regard, the premixed flame model (5201BC) and the miniature inverted soot generator produced particles with AAC closer to 1.0 (the desired value for a fresh-like soot source).
- The desired particle diameters were obtained only from the four different mini-CAST burners. However, in the literature it can be found that spark generators and the miniature inverted soot generator are also able to produce particles with diameter < 100 nm.
- Further investigations will include the analysis of samples by EC/OC thermography, Raman microspectroscopy and transmission electron microscopy.

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