Determination of thermal accommodation coefficient and primary particle size of soot through light scattering method

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Soot particles are considered to be the second most important factor in the anthropogenic radiative forcing underlying climate change and can influence cloud formation [1]. Airborne soot also has negative impacts on human health, both directly and as a carrier of other toxic materials [2]. Light scattering-based methods, such as elastic light scattering (ELS) and laser-induced incandescence (LII), provide non-invasive diagnostic techniques for characterizing the morphological properties of these particles. Unfortunately, the morphology measurement involves solving an inverse problem, so an uncertainty of some key LII model parameters like the thermal accommodation coefficient (α_T) will lead to obviously inaccurate results. Considering the debate on the actual value of α_T employed in the LII model [3], it is worth simultaneously retrieving α_T and target morphology parameters from the temporal LII signal. In this work, the fractal dimension and aggregate size distribution of polydisperse soot particles are retrieved from the relative intensity of angular ELS, which is based on our previous work [4]. These parameters determined by ELS are then used as input parameters of the temporal LII model to simultaneously retrieve the thermal accommodation coefficient and primary particle size.

References

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