About a new Coagulation Measurement Device (CMD)

Bernhard A. Heiden
Institute for Internal Combustion Engines and Thermodynamics, University of Technology Graz, A- 8010, Graz, Austria

INTRODUCTION

As nanoparticles in air pollution have a high impact on human health and the dispersion of these particles can not be predicted very well, clarification of aerosol growth is necessary.

METHODS

A mobile coagulation measurement device (CMD) was developed, measuring the coagulation coefficient (K) of nanoparticles, where K is a basis quantity for the kinetics of aerosols. A constant concentration aerosol reactor has been built, tested and automated with LABVIEW for the first time, allowing for a variable volume and time dependent concentration measurements of the same aerosol. A theory was adapted for the CMD based on the fundamental general dynamics equation (GDE), which is reduced to the form of a special logistic equation, taking coagulation and diffusion into account.

RESULTS

The measurement of the number concentration decay and of their distribution allows, together with the developed theory, for the evaluation of K with a number of different methods. All methods can be depicted in Figure 1. The results from the measurement theory adapted for the built CMD (Heiden, 2006) are depicted with solid lines, the corresponding results from Rooker and Davies (Rooker and Davies, 1976) with the dotted lines. The four methods correspond to measuring the initial slopes or the whole range (gamma=0,1). The flexibility of the CMD allows for measuring with all four methods. The resulting values of K reflected that from the literature.

DISCUSSION

The two continuous concentration measurement methods yielded, compared to the two discontinuous methods, for the limiting case of short times, an average 5 times higher K, expected to yield the better values due to improved measurement analysis. Fluctuations of aerosol sample conditions might have caused differences in K including the influence of different aerosol dilution.

CONCLUSIONS

A new portable measurement instrument for measuring the coagulation coefficient has been developed, applicable both for investigation and as standard measurement instrument. The measurement of the values of K for the first test aerosols are in the size range of measurements from literature. Future research areas are the application of the CMD to the distinction of various aerosols, the investigation of the particle form, and derivation of a general K.

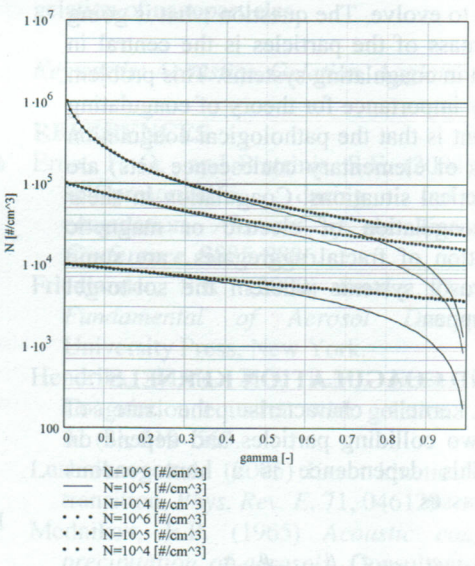

Figure 1. Comparison of the measurement of the effective coagulation coefficient K with the CMD and the method of Rooker and Davies (Rooker and Davies, 1976). N is the total particle concentration, gamma is dimensionless parameter describing the state of coagulation chamber (settler) (0=open; 1=closed)

Keywords: *Coagulation, Measurement, Device, Nanoparticles*

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This work was supported by the FVT.