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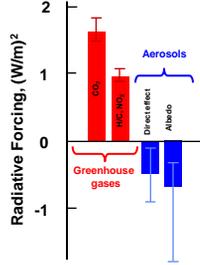
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Motivation

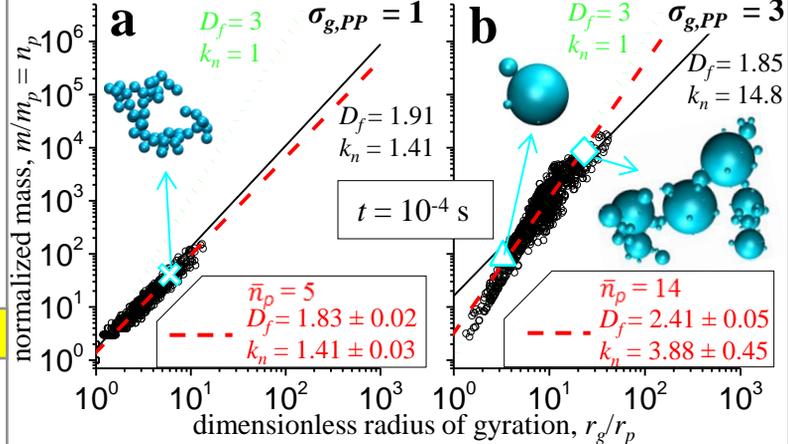
Brownian coagulation of fractal-like agglomerates consisting of *polydisperse* primary particles (PPs) is investigated by discrete element modeling (DEM) in free molecular regime.

Aerosols affect air pollution by absorbing & scattering light. Their structure affects handling & processing and finally agglomerate performance.

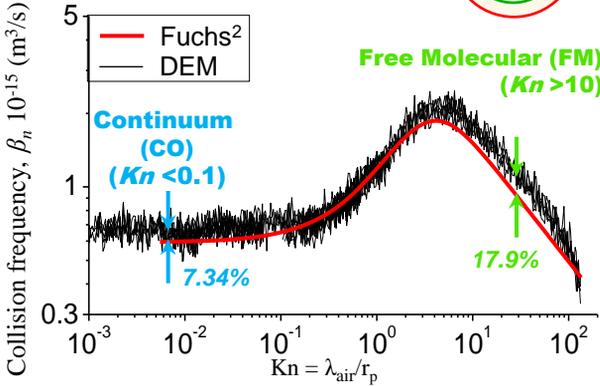
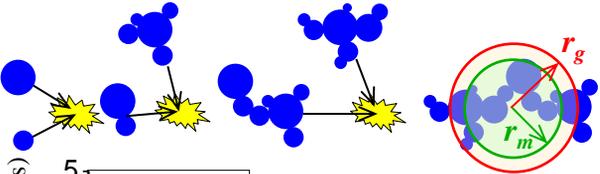
Understanding agglomerate dynamics can facilitate optimal process design of aerosols synthesis of materials, flocculation of suspensions, monitoring combustion emissions and climate modeling.



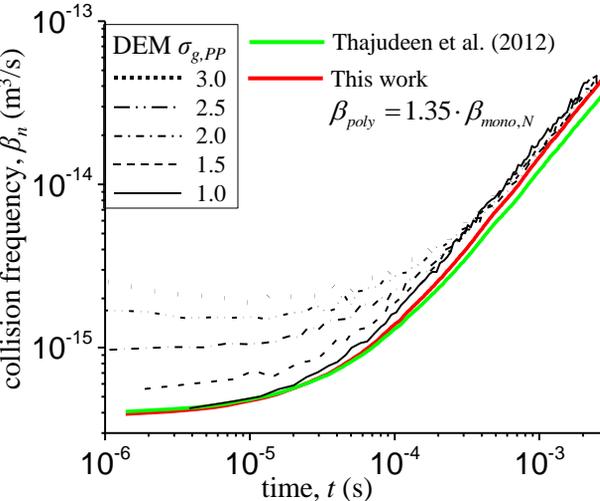
Agglomerate Morphology



Method¹ & Validation

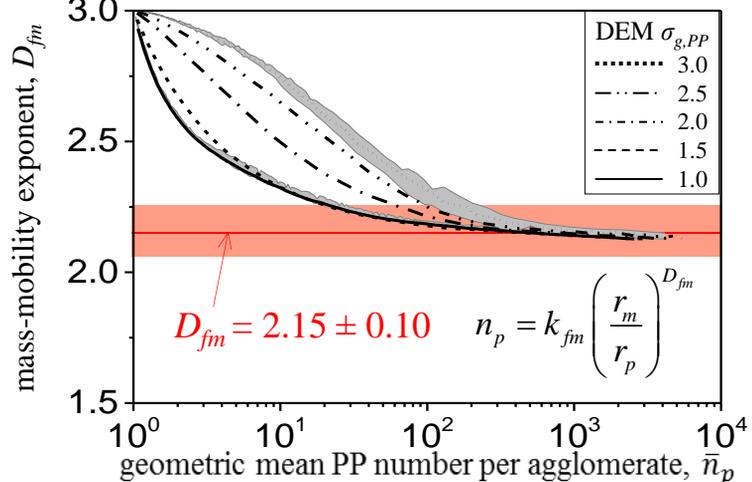
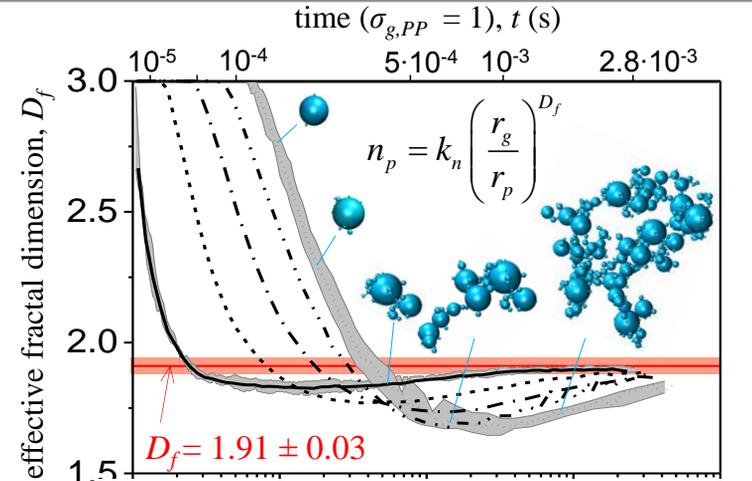


Agglomerate Dynamics



Agglomerate β_n for PPs of polydispersities, $\sigma_{g,PP} = 1 - 3$ by DEM (black lines) and collision kernels of Mountain et al.³ (1986) enhanced by 35% and Thajudeen et al.⁴ (2012; green line).

Evolution of agglomerate structure by coagulation in dimensionless mass-radius of gyration, r_g , space.



Evolution of D_f and D_{fm} during agglomeration of polydisperse PPs with $\sigma_{g,PP} = 1 - 3$.

References

- Goudeli E, Eggersdorfer ML, Pratsinis SE. (2015) *Langmuir* 31, 1320
- Fuchs NA. (1964) The mechanics of aerosols
- Mountain RD, et al. (1986) *J. Colloid Interface Sci.* 114, 67
- Thajudeen T, et al. (2012) *Aerosol Sci. Technol.* 46, 1174

Conclusions

- The primary particle (PP) polydispersity ($\sigma_{g,PP}$) delays the attainment of asymptotic D_f and D_{fm} .
- Agglomerate dynamics are independent of $\sigma_{g,PP}$ once agglomerates reach their asymptotic D_f .
- Increasing the well-known number concentration-based collision kernel of monodisperse agglomerates by 35% captures reasonably well the asymptotic collision frequency function in the free molecular regime, regardless of PP size distribution especially once the self-preserving size distribution (SPSD) has been attained.