Contribution ID: **600** Type: **Poster Presentation**

Numerical study of single droplet drying in an acoustic levitator

Tuesday, 31 May 2022 15:20 (1h 10m)

To examine the drying kinetics inside a spray dryer, it is essential to understand the heat-induced transformation of a single colloidal droplet into a solid dry particle. During the last decades, numerous researchers applied acoustic levitation to perform single droplet drying experiments using a standing ultrasound wave to immobilize the droplet in one of its pressure nodes. Even if this approach requires no physical contact, secondary acoustic effects (namely the acoustic radiation pressure and the acoustic streaming) still have a significant impact on the heat and mass transfer within the area of levitation. Our aim is to investigate the drying and particle formation of a single colloidal droplet in an acoustic levitator by means of mathematical modeling and numerical simulations [DB22]. More precisely, we apply the finite element method to simulate the phase transitions during the drying process and to quantify the impact of the aforementioned secondary acoustic effects. Once a critical amount of solvent has evaporated from the droplet, its liquid suspension turns into a porous medium consisting of a wet core and a dry crust. The evaporation front is modeled as a sharp interface and the drying rate is derived locally from the thermodynamic non-equilibrium between the saturated and the actual vapor pressure. Finally, empirical data from the literature and our collaboration partners are taken into account to confirm the validity of our numerical results.

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References

[DB22] Martin Doß, Eberhard Bänsch, Numerical study of single droplet drying in an acoustic levitator before the critical point of time, Chemical Engineering Science, Volume 248, Part A, 2022, 117149, https://doi.org/10.1016/j.ces.2021.117149.

Time Block Preference

Time Block B (14:00-17:00 CET)

Participation

Online

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