THE UNDERSTANDING OF SILICON SEQUENTIAL ELUTRIATION BEHAVIOUR

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During the fluidization of broad PSD (Particle Size Distribution) powders, elutriation can not be avoided, but has to be process controlled. Batch elutriations of continuous PSD powders were studied in a laboratory scale fluidized bed. The reference sample was metallurgical-grade silicon powder, with non-spherical shape.

The smallest elutriable fines, namely superfines (<10 µm) are entrained first. However, the largest elutriable particles (Ut ~ Ug) do not begin to be entrained simultaneously, but only after a delay that is as long as the time required for the superfines to leave the bed, thus inducing sequential elutriation (Figures 1). When no superfines were present, the entrainment was not delayed. This peculiar phenomenon was observed at all of the tested gas velocities (0.05-0.2 m/s). The superfines thus seem to strongly limit the elutriation of the larger elutriable particles. This sequential behaviour is particularly interesting to separate particles according to a small and narrow PSD (Figure 2).

These phenomena are related to interparticle interactions within the bed and/or the freeboard and confirm the importance of polydispersity in the elutriation behavior. Thanks to the elutriation mathematical models developed in this study, the behavior that was thought to be explained by Silicon attrition can now be explained by sequential elutriation.

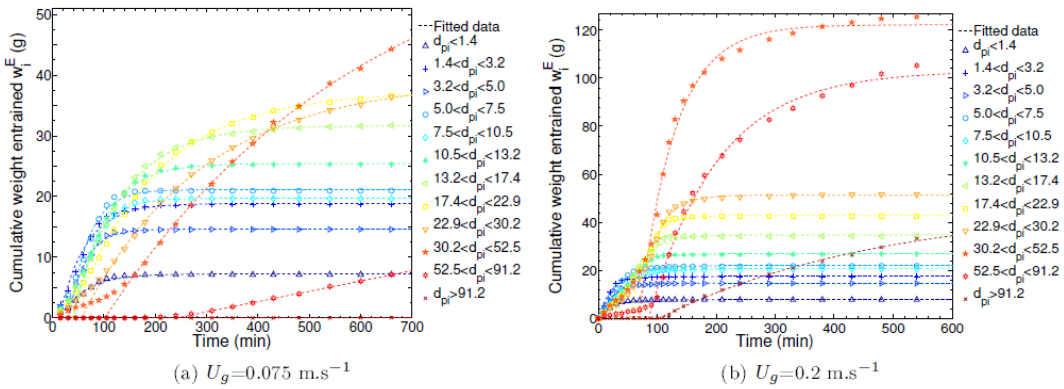

Figure 1 : Cumulative entrained weight per size interval for all elutriating fractions at 0,075 m/s (a) and 0,2 m/s (b)

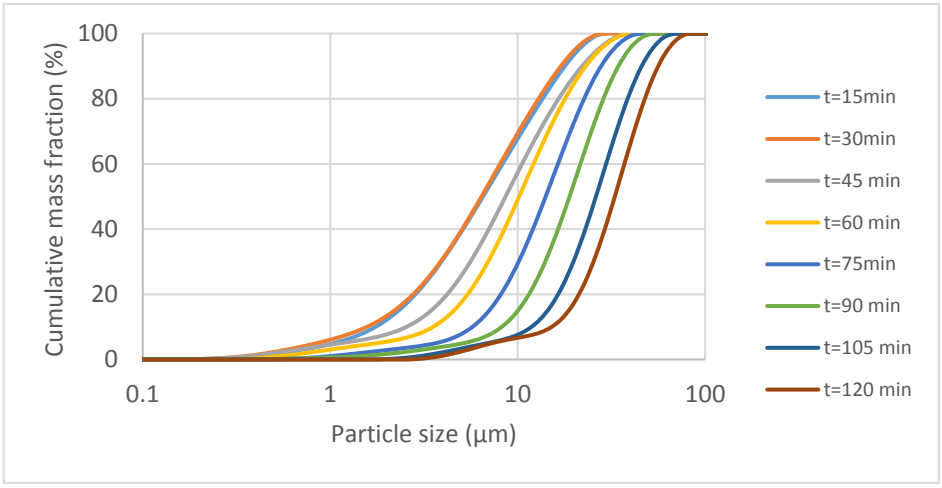

Figure 2 : Evolution of cumulative PSD (Particle Size Distribution) of elutriated particles collected in function of time