Modeling the size distribution in a fluidized bed of nanopowder

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Material Specifications

Table 1: Properties of the nanoparticles as provided by the manufacturer.

Powder	ρ_p (kg m^{-3})	d_p (nm)
TiO_2 P25	4000	21
Al_2O_3 AluC	3600	13
SiO_2 A130	2200	16

The size distribution of all powders was determined from TEM images analyzed with the open source software ImageJ. The mean primary particle sizes measured were 22 $\pm$ 7 nm, 8 $\pm$ 2 nm, and 16 $\pm$ 7 nm for P25, AluC, and A130, respectively (Figure 1). The discrepancy in the size of AluC particles with respect to nominal values given by the supplier could be attributed to the particle overlap or partial sintering seen on the TEM images. Additionally, industry use the gas absorption-desorption method for particle sizing, which most likely results in different values than image analysis.

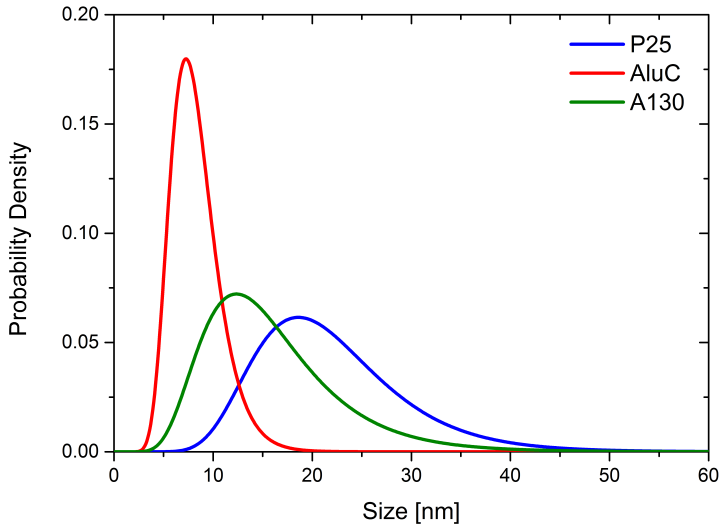
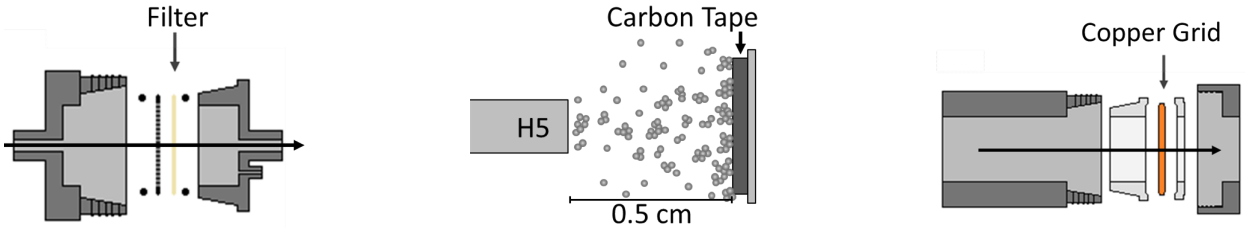


Figure 1: Primary particle size distribution of titania (P25), alumina (AluC), and silica (A130) nanopowders. Values were obtained from TEM images analyzed by the open source software ImageJ.

Microscope analysis sampling method

Three different methods were used to capture samples from the fluidized bed for TEM and SEM imaging.



(a) (b) (c)

Figure 2: a) 50 nm mesh filter, b) Double sided carbon tape, and c) copper grid holders for airborne particles capture. The filter and carbon tape are used for SEM analysis, and the copper grid for TEM imaging. The arrows show the flow direction from the fluidized bed sampling port.