**Supplemental Information (SI)**

Deagglomeration testing of airborne nanoparticle agglomerates—stability analysis under varied aerodynamic shear and relative humidity conditions

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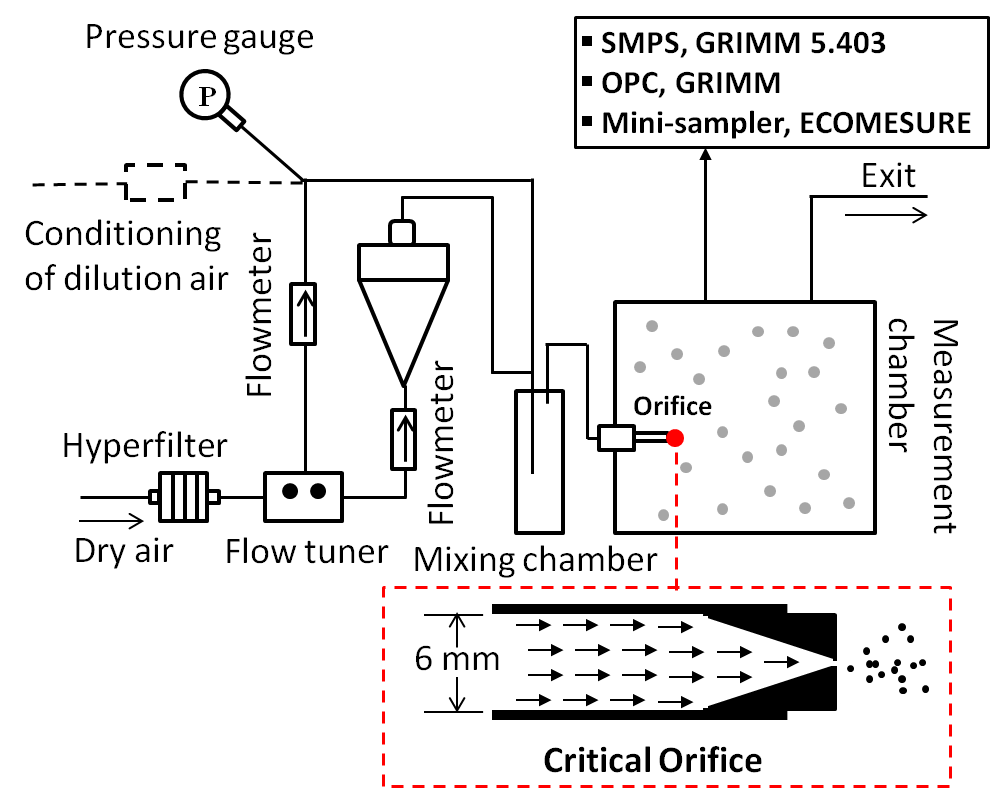
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Figures: 5

Tables: 1

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(a)



(b)

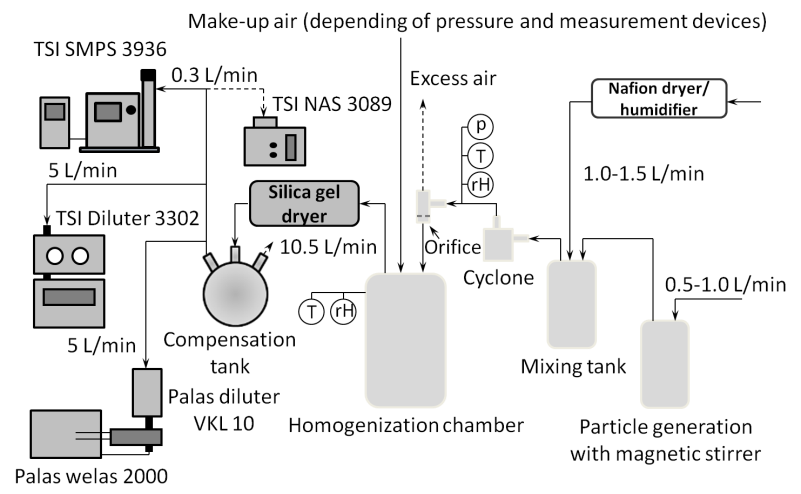


Figure S1. Schematic diagrams of the funnel (a) and the stirrer systems (b) used for the deagglomeration tests

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Hydrophobic TiO2 | | Hydrophilic TiO2 | |
| RH/∆P | rs | p | rs | p |
| 0 | -0.9418 | <0.0001 | -0.9383 | <0.0001 |
| 25% | -0.942 | <0.0001 | -0.6913 | 0.0004 |
| 50% | -0.942 | <0.0001 | -0.8727 | <0.0001 |
| 75% | -0.8425 | <0.0001 | -0.9304 | <0.0001 |
| 0 kPa | -0.0664 | 0.7322 | 0.8638 | <0.0001 |
| 50 kpa | 0.9684 | <0.0001 | 0.9055 | <0.0001 |
| 100 kpa | 0.8633 | <0.0001 | 0.9463 | <0.0001 |
| rs, Spearman’s rank coefficient, positive correlation (+) and negative correlation (-); p, statistical significance. | | | | |

Table S1. Correlations of mean particle size to pressure drop under four different RH values (Figure 3 a,b) and correlations of mean particle size to RH under the three pressure drop conditions (Figure 3 i,j).

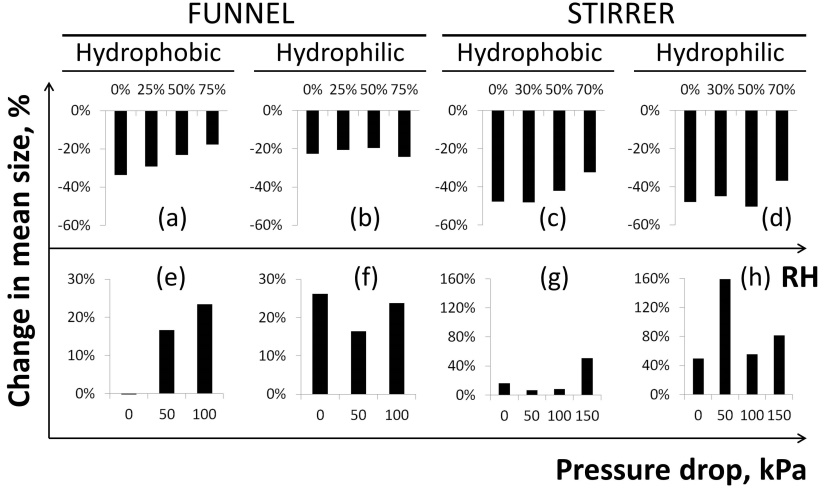


Figure S2. Influence of relative humidity (a–d) and pressure drop (e–h) on change in mean particle size. The results show the increase (+) or reduction (-). Charts a–d: total reduction in particle size by increasing pressure drop from 0 to 100 (funnel) or to 150 kPa (stirrer), under different humidity conditions; e-h: total increase of particle size by increasing relative humidity from 0 to 75% (funnel) or 70% (stirrer), under different pressure drops.

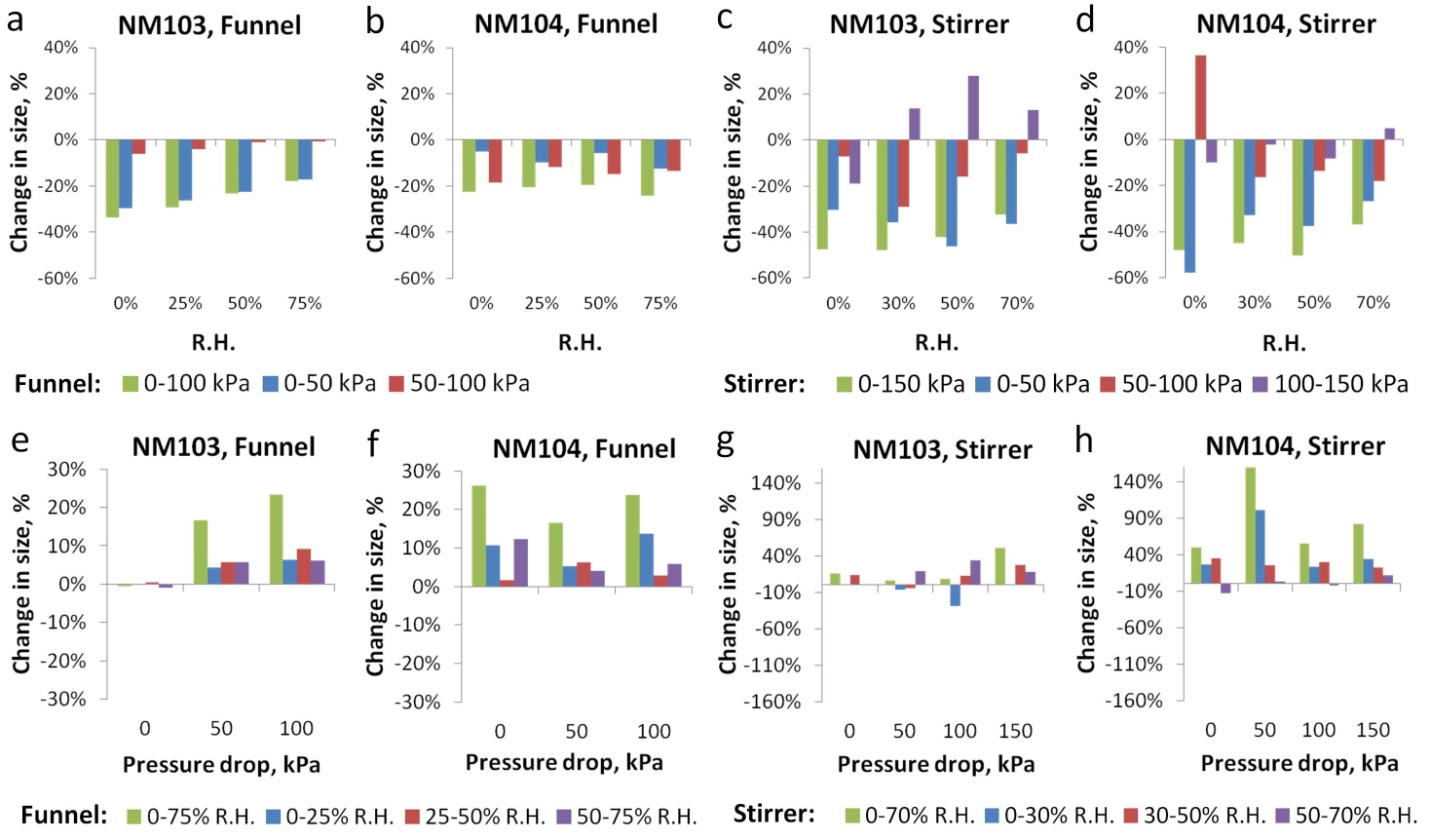


Figure S3. Influence of pressure drop and relative humidity on mean particle size. The results show the relative change of mean particle size (in % between indicated pressure drop or RH conditions)

**Figure S3:** For hydrophilic TiO2 NM-103 particles in the funnel system, the effects of a pressure drop from 0 to 50 kPa were much more significant than the effects from 50 kPa to 100 kPa (a, comparing blue to red rectangles). However, for hydrophobic TiO2 NM-104 particles in the funnel system, average mean particle sizes decreased more with a pressure drop from 50 to 100 kPa than with one from 0 to 50 kPa (b, comparing blue to red rectangles). In the stirrer system, the pressure drop effects for both materials were most prominent in the 0–50 kPa range (c and d, comparing blue to red or purple rectangles). The analysis shows that in order to achieve the same degree of size reduction, the hydrophilic particles require a higher pressure drop than for the hydrophobic ones. This is the case for the aerosol particles generated in the funnel system. For larger particles obtained from the stirrer system, most of the size reduction effect could already be observed in the 0 to 50 kPa pressure drop range, for both two materials.

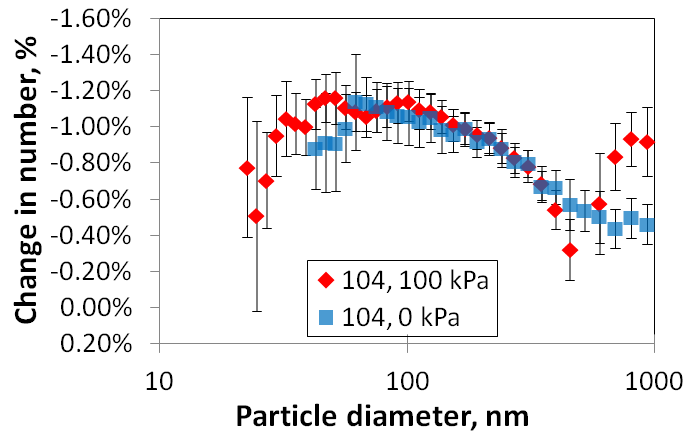
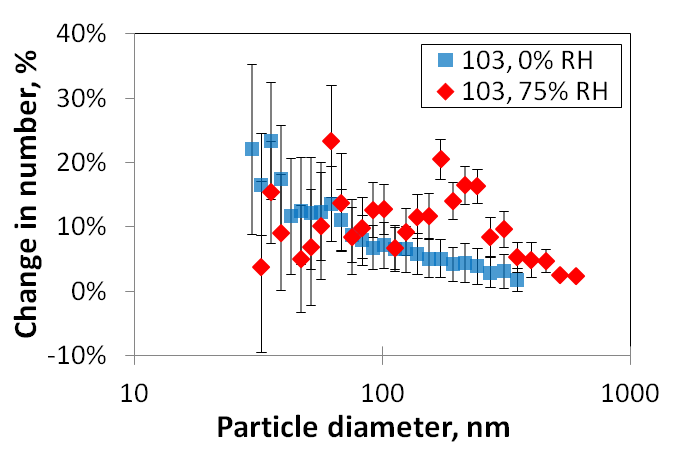
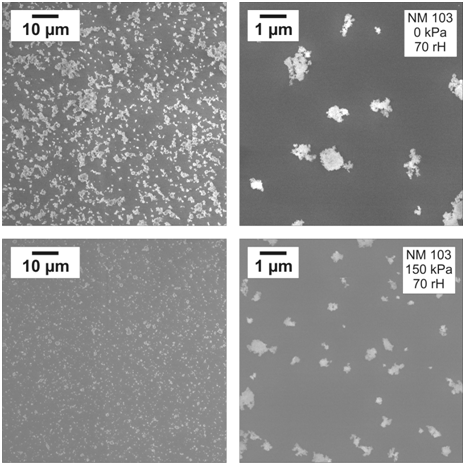
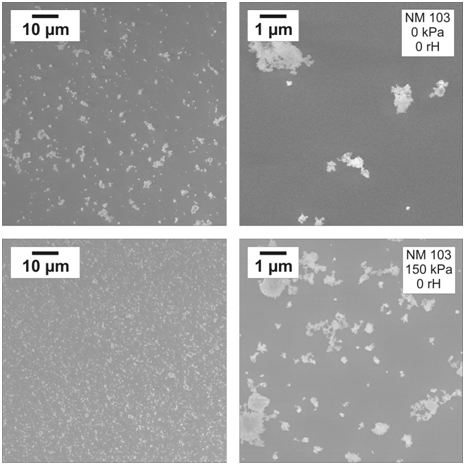


Figure S4. Comparison of changes in particle number in individual size channels (measured by SMPS) by increasing pressure drop at 0% and 75% RH conditions (left) and by increasing relative humidity at 0 and 100 kPa conditions (right). Only statistically significant values are plotted (p < 0.05). Error bars represent 95% confident intervals. Data are from the funnel system for the hydrophobic (NM-103) and hydrophilic (NM-104) TiO2 aerosols.



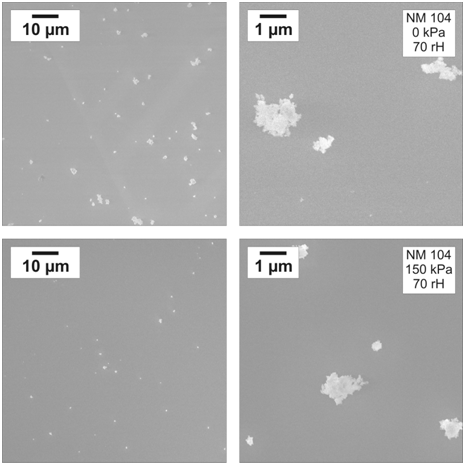
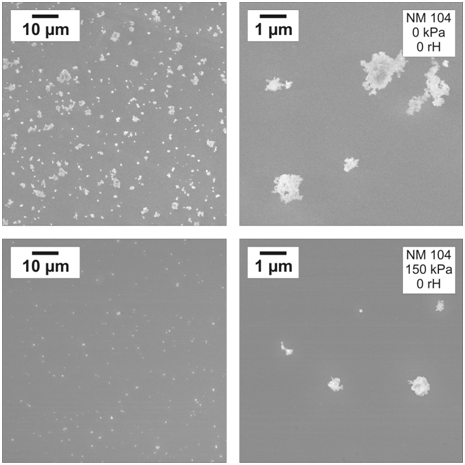


Figure S5. Scanning electron microscope observations of particle morphology in the stirrer system.