EFFECT OF SIEVING AND ISOPROPANOL ON THE FLUIDIZATION BEHAVIOR OF TIO2 NANOPARTICLES

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The fluidization of ABF nanoparticles has gained the attention of many researchers due to its interesting applications but difficult fluidization. Typically, these particles are sieved to remove the large agglomerates that are formed during storage. Otherwise, the larger agglomerates stay near the distributor plate, hindering the proper fluidization of the nanoparticles due to the formation of channels throughout the bed. To solve that, several papers propose to improve the fluidization conditions using external assistance methods. Such methods impose an external force that can break up the agglomerates; examples are magnetic or electric fields, vibration or centrifugal beds [1]. A different approach is to change the surface properties of the nanoparticles, decreasing the cohesive forces. Tahmasebpooret al. [2] analysed the influence of the hydrogen bonds during the fluidization of nanoparticles. They showed that the use of isopropanol vapour (ISP) in the fluidizing gas can reduce the cohesive forces between nanoparticles increasing the bed aspect ratio.

Sieving of nanoparticles and the use of ISP in the gas stream have been commonly used to improve the fluidization quality during the last years. However, the influence of both processes on the fluidization behaviour has not been studied in detail. For the former, the effect of the sieving size on the bed dynamics is still unknown. Regarding the ISP, its influence for long fluidization times has not been addressed yet. For instance, whether the ISP should be continuously on the gas stream or working with gas pulses to improve the fluidization has not been clarified.

Therefore, the objective of this experimental work is to further understand the influence of the sieving size and the effect of ISP during the fluidization of TiO_2 nanoparticles. The experiments are carried out in a 5 cm inner diameter column with a porous distributor. Nitrogen is used as fluidizing gas. The experiments are analysed using a 2D tomography setup. The attenuation of the X-rays are measured when they go through the fluidized by a plate detector, with a size of 30 cm x 30 cm and 1524x1548 pixels. The fluidization of TiO_2 nanoparticles sieved with a 350 µm mesh shows higher bed expansion than the powder sieved with a 850 µm mesh. Considering the effect of time, the use of ISP initially increases the bed expansion, but after that the bed height decreases faster than for the situation without ISP.

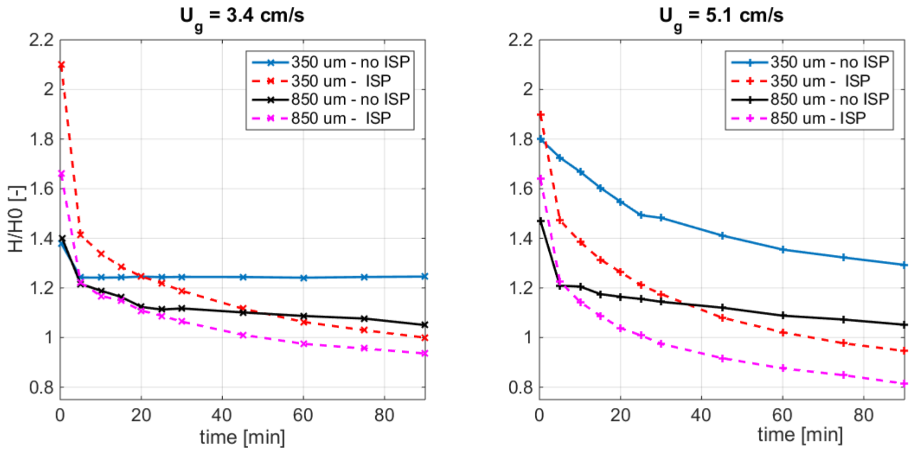

Figure 1.Bed height as a function of time.

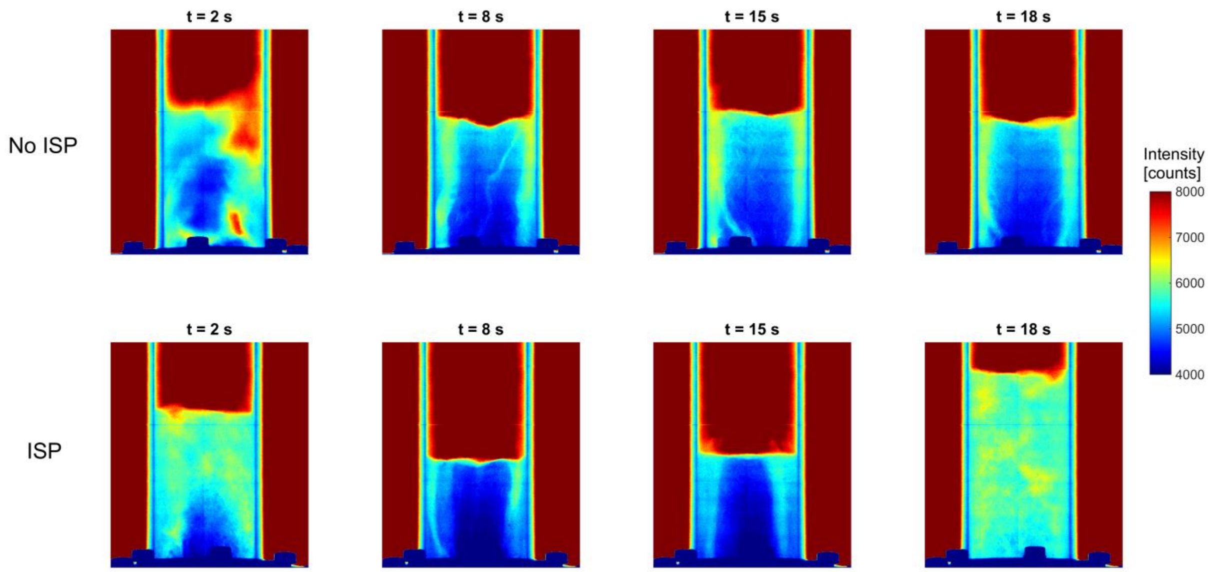

Figure 2. Snapshots obtained using the 2D tomography system for the beginning of the fluidization experiment at U_g = 3.4 cm/s, with 350 µm sieve without and with ISP. Channels appear near the bed walls when only nitrogen is used (blue line on Fig. 1). In contrast, the use of ISP since the beginning of the test shows a meaningful influence on the channels collapse and the bed fluidization (red line on Fig. 1).

REFERENCES

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