

铝 + 纳米碳管

行业:	Chemistry
进料尺寸:	~ 45µm
最终精度:	two sample bags of badly segregated sample mixtures.
样品量:	homogeneous mixture (no grinding)
研磨建议:	4g

For mixing of both kinds of sample, the Mini-Mill PULVERISETTE 23 is capable. With the 15ml zirconium oxide bowl, 5mm Ø (for Al-sample) and 10mm Ø balls (for Ni-B-Si sample) are needed. Probably adding a few drops of solvents like isopropyl alcohol can improve the mixing (see result 4 /7).



MINI-MILL PULVERISETTE 23

speed: 50 Hz

15 ml grinding bowl made of zirconium oxide (ZrO₂)
 +5x 10 mm ZrO₂ balls

Material attributes:	sample: Al + CNT
Feed quantity:	4 g mixed sample
Feed Size:	~ 45 µm
Grinding time:	5 min
Final fineness:	sticking sample
Comments:	After the first minute of grinding, it appears that carbon particles just use to be loose inside of the aluminum powder. We are guessing that the sample will segregate after packing.

After totally 5 minutes of grinding, pieces of aluminum have been pressed together (forming flakes) and a few pieces of sample use to be more coarse as the start size afterwards.





Sample Al-CNT before starting the trial.



Emptied bowl after 5 minutes. The sample become ground, compressed sample is still sticking to the 10mm Ø zirconium oxide balls (formally white).



MINI-MILL PULVERISETTE 23

speed: 50 Hz

15 ml grinding bowl made of zirconium oxide (ZrO₂)

+45x 5 mm ZrO₂ balls

Material attributes: **sample: Al + CNT**
Feed quantity: 4 g mixed sample
Feed Size: ~ 45 µm
Grinding time: 10 min
Comments: After 3 minutes of mixing with 5mm Ø balls, the sample uses to look like the sample of result 1 after 1 minute.

After 10 minutes, the sample appears to be more homogenous mixed. We prepare a further trial with longer mixing time (see result 3) to check if the optical properties might change.



Sample after 3 minutes of grinding.



Sample after totally 10 minutes of grinding.



MINI-MILL PULVERISETTE 23

speed: 50 Hz

15 ml grinding bowl made of zirconium oxide (ZrO₂)

+45x 5 mm ZrO₂ balls

Material attributes:

sample: Al + CNT

Feed quantity:

4 g mixed sample

Feed Size:

~ 45 µm

Grinding time:

30 min

Final fineness:

mixed

Comments:

This trial was done analogous result 2. After totally 30 minutes of grinding, the optical appearance seems to be equal to result 2, so 10 minutes might be fulfilling for mixing.



MINI-MILL PULVERISETTE 23

speed: 40 Hz

15 ml grinding bowl made of zirconium oxide (ZrO₂)

+ 5x 10 mm Ø ZrO₂ balls

Material attributes:

sample: Al + CNT

Feed quantity:

4 g mixed sample

Feed Size:

~ 45 µm

Additive:

+ 10 drops IPA

Grinding time:

2 min

Final fineness:

mixed

Comments:

With the used 10mm balls (like used in result 1), probably a lower speed between 30-40Hz should be chosen to hinder a milling of aluminum. To be on the save side, we recommend using 5mm Ø balls.

For a better mixing between carbon nano tubes and aluminium, it is also possible moistening the sample with a little bit of solvent (e.g. isopropyl alcohol). After only 2 minutes with lower speed, sample looks homogenous without a grinding of the aluminum particles. Probably even 1 minute might be fulfilling. Probably the carbon nano tubes use to detach after the sample dried up.