

Calendering of freeze-cast MXene aerogel I

Date: 2021-10-18

Tags: Freeze-cast Calendering Aerogel 11/10/2021 Synth Nanoplexus 200 2021

Created by: James Bird

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Goal : Use calender press to compress freeze-cast $\text{Ti}_3\text{C}_2\text{T}_z$ MXene aerogels to a precise thickness

Procedure :

- Freeze-cast aerogels (both Sample #1 & 2 in [\[Experiment\] Freeze-casting of \$\text{Ti}_3\text{C}_2\$ MXene suspension I](#)) are first compressed manually and uniaxially in the template in which they were initially fabricated, parallel to the length, L_1 , of the sample. Compression is carried out using components of the template to ensure the $W \times H$ dimensions are maintained during the compression. The manual compression must lead to a new length, L_2 , greater than the final length from calendering, L_3 .
- Place each sample between two sheets of greaseproof paper.
- Calibrate roller separation with allen keys of known width placed between rollers to achieve either $L_3 = 5$ or 2.5 mm, for Sample #1 and 2, respectively.
- Turn on calender and feed samples through multiple times, where each time the sample is rotated 90° around the axis perpendicular to the largest sample dimensions. 5 pass-throughs total.

Results :

$L = L_3$ is now referred to as the thickness, as the smallest sample dimension. In order to achieve thicknesses of 5 or 2.5 mm, the top plate of the press attached to the top roller had to be extended beyond the height for which it was manufactured by loosening screws. Doing so renders the thickness gauges (MEIXIN) useless and hence reduces precision. There is also a risk of exposing the user to electrical components.

Qualitatively, the use of unsealed greaseproof paper instead of the tissue paper used previously in [\[Experiment\] Calendering of freeze-cast MXene aerogel](#) performed much better. Nanomaterial transfer is negligible and no bunching/crumpling is observed. Sample #1 density is increased from $1.72 \times 10^{-2} \text{ g cm}^{-3}$ to $4.06 \times 10^{-1} \text{ g cm}^{-3}$ in a sample of dimensions of $5 \times 15 \times 15$ mm ($L \times W \times H$), whilst Sample # 2 is estimated at $3.25 \times 10^{-1} \text{ g cm}^{-3}$ (see [\[Experiment\] Freeze-](#)

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casting of Ti₃C₂ MXene suspension I) in sample dimensions 2.5 x 15 x 15 mm (L x W x H).

The attached image shows Sample #1 post-calendering.

Conclusions:

To avoid the need to extend the roller height beyond it's manufactured capabilities, target thickness should be reduced to \approx 1.4 mm. The use of greaseproof paper to guide material through the calender press is much preferable to tissue paper.

Attached file

IMG_1699.JPEG

sha256: a18ff9ed109620704eb931a655259fa6700195eef9aa01e709aead04a2f8693c



Unique eLabID: 20230416-3dfab13acef642f91835251850a5646fc1a2ec44

Link: <https://frankel-elab.manchester.ac.uk/experiments.php?mode=view&id=104>