Comparative study of spray dried and roller dried calcium caseinates on structure formation

---- for meat alternative

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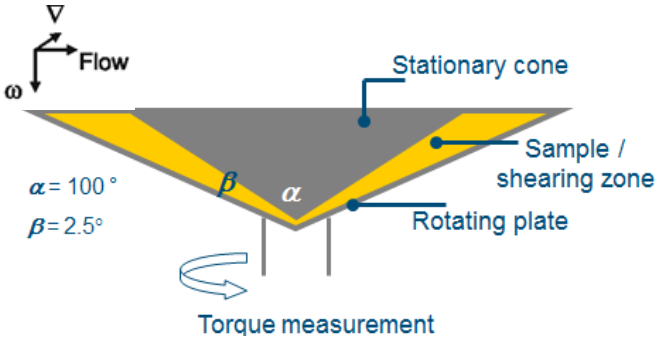
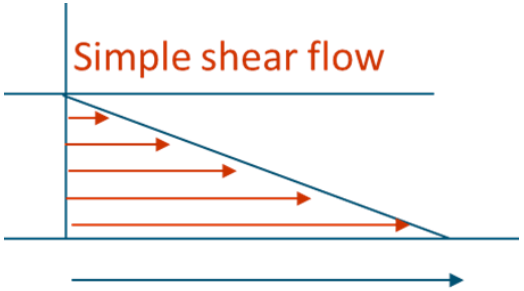
“Anisotropic structure formation depend on the arrangement of air bubbles under shear flow in dense calcium caseinate system.”

Shear cell technology





30g Calcium Caseinate
70g water
Tgse(E:S=1:20)

50 rpm, 50 ^{0}C, 5 min

- No break-up of structure elements
- Viscous biopolymers
- Coupling to rheological phenomena

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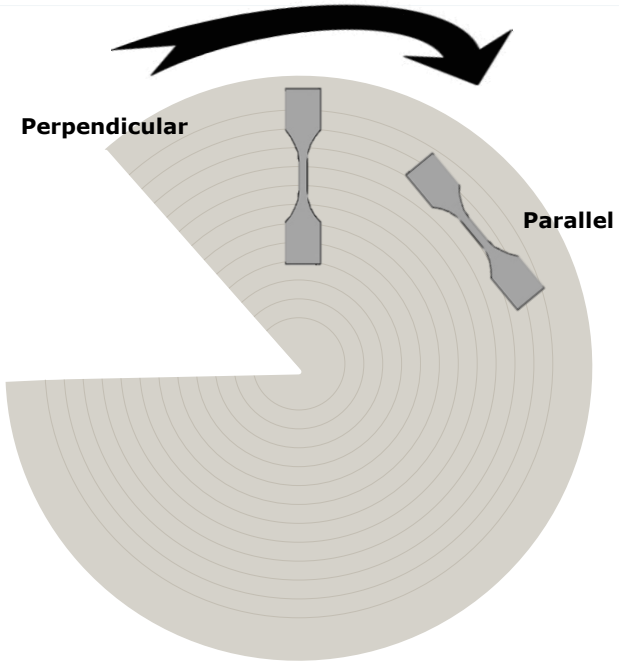
Approach

- Visual observation
- Mechanical analysis
- Microscope
- Rheometer



- Anisotropy index can be calculated.

$$A.I._{\sigma} = \frac{\sigma_{Parallel}}{\sigma_{perpendicular}}$$

$$A.I._{\varepsilon} = \frac{\varepsilon_{Parallel}}{\varepsilon_{perpendicular}}$$

$A.I._{\sigma}$ >2 is defined fibrous structure.

Challenge & objective

Understand the characteristics of dense CaCas dispersions in relation to **structure formation capabilities**.

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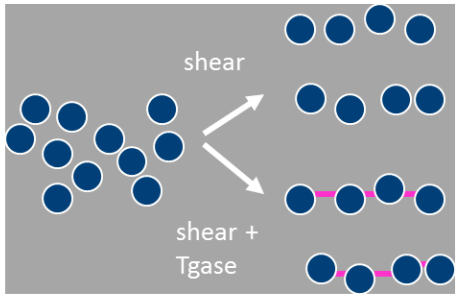
For quality of life

*Manski, J. M., L. E. van Riemsdijk, A. J. van der Goot and R. M. Boom (2007). "Importance of intrinsic properties of dense caseinate dispersions for structure formation." Biomacromolecules **8**(11): 3540-3547.*

Grabowska, K. J., et al. (2012). "Salt-modulated structure formation in a dense calcium caseinate system." Food Hydrocolloids 29(1): 42-47.

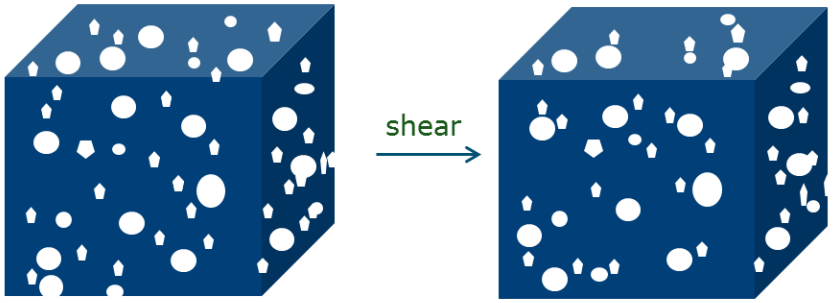
Hypothesis

Nano

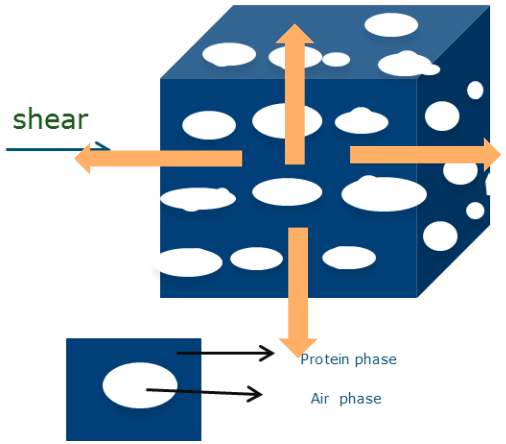


Micelle
Tgse

Micro



Perpendicular

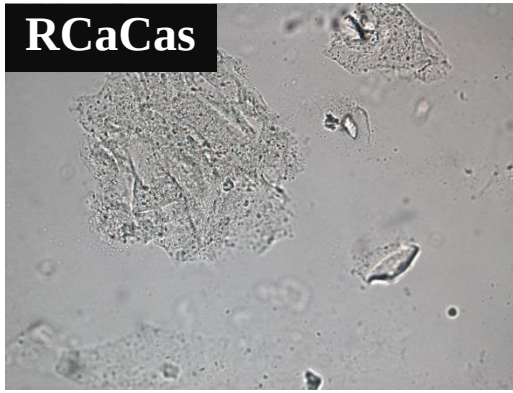


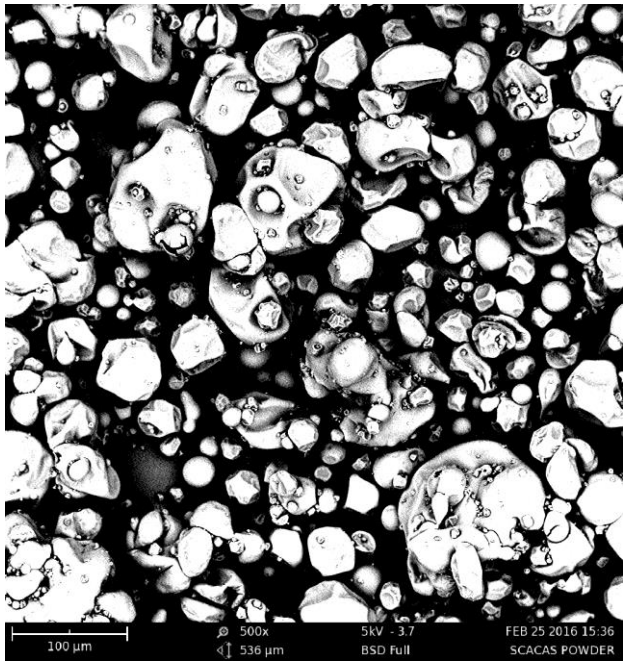
Parallel

Ingredients property

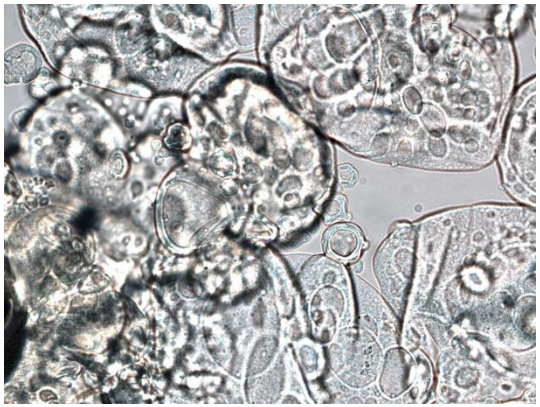
Components	SCaCas	RCaCas
Protein (%, N×6.38)	91.0	91.8
Moisture content (%)	6.40	6.04
Calcium content* (%)	1.50	1.20
pH (10% sol. 20 ^{0} C)	6.9	6.7
Reactive Lysine (mg/g)	4.21	0.76
Micelle size (nm)	199	187

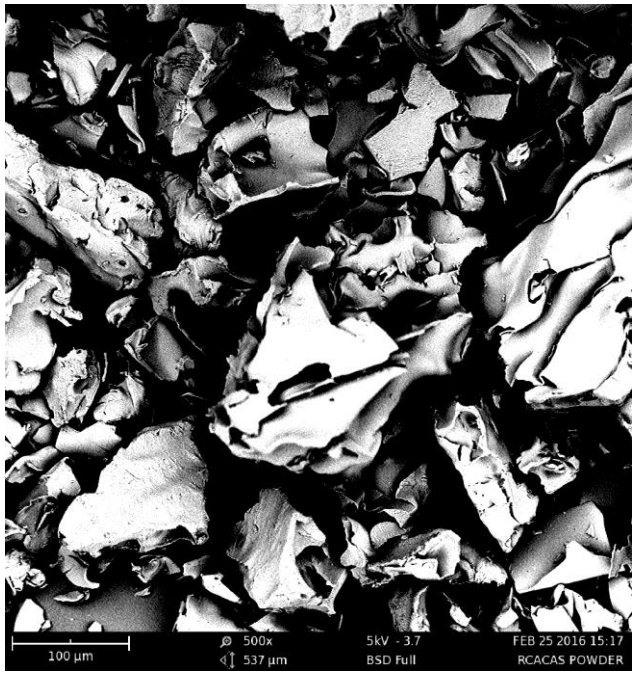
RCaCas





SCaCas





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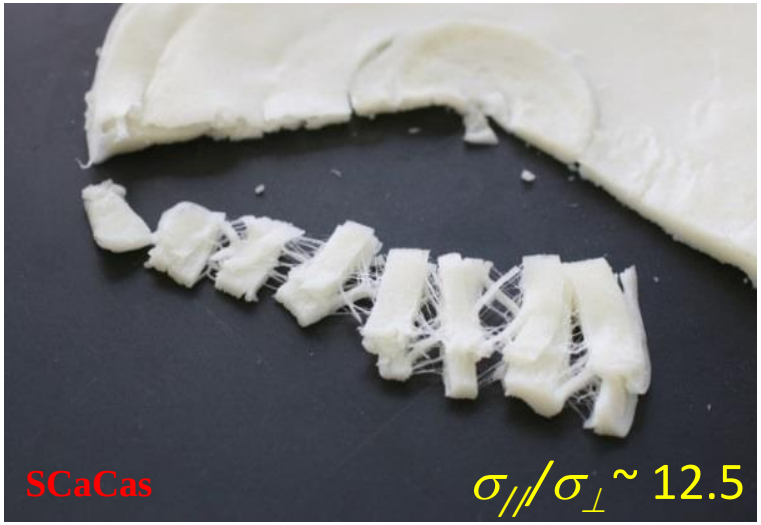
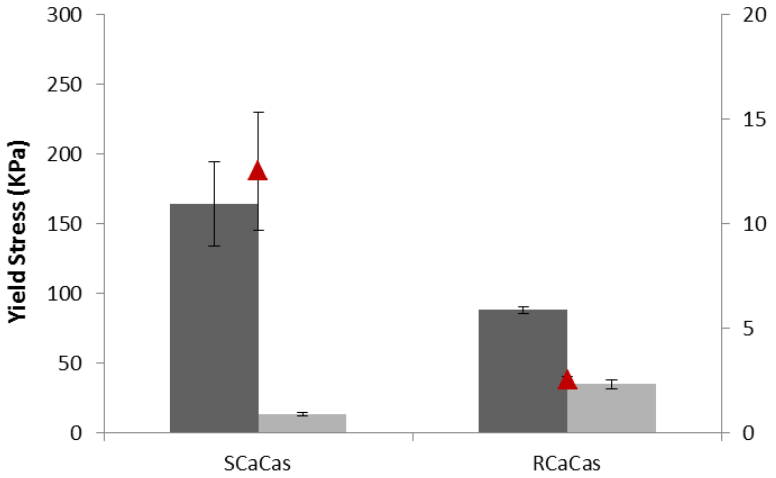
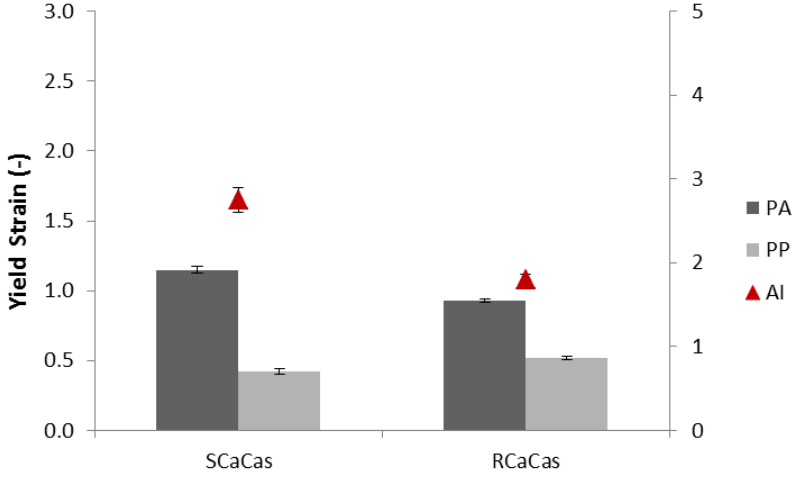
Mechanical property







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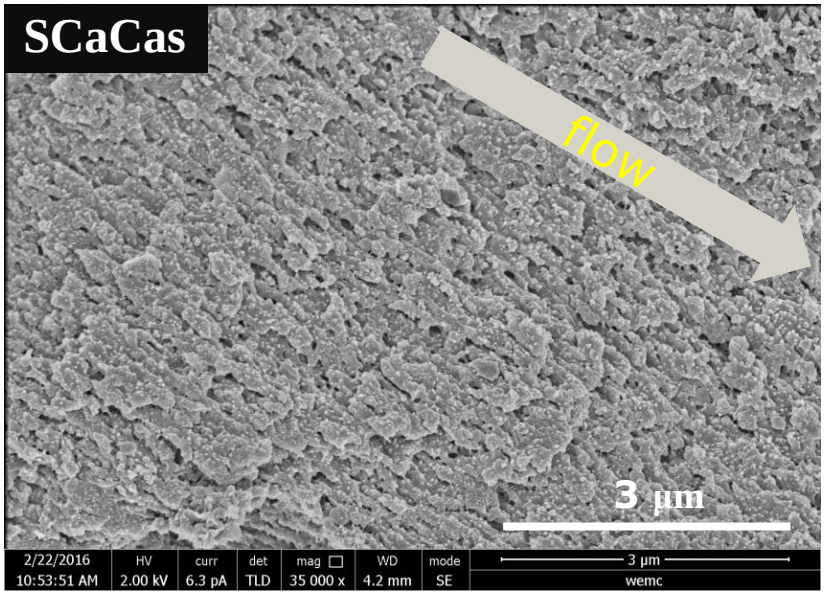
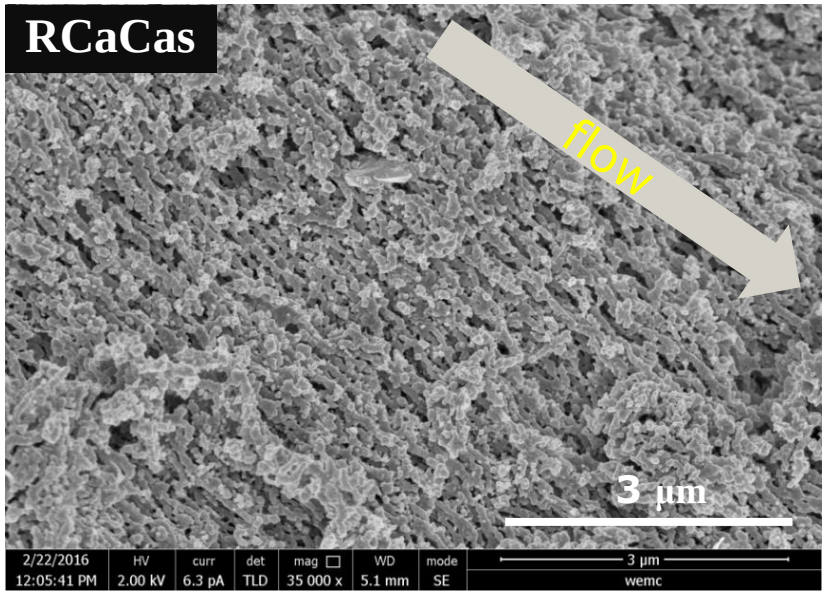
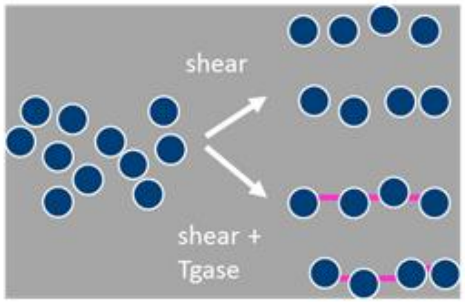
Alignment nanoscale





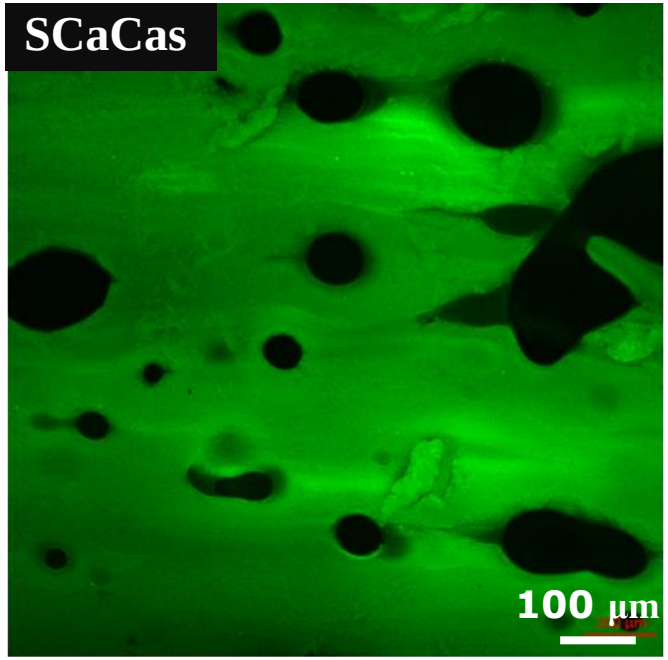
Nano

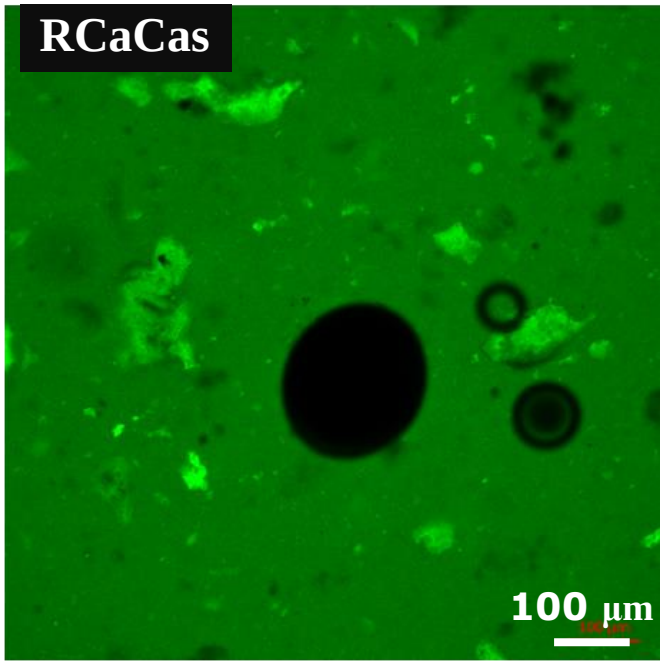


Micelle

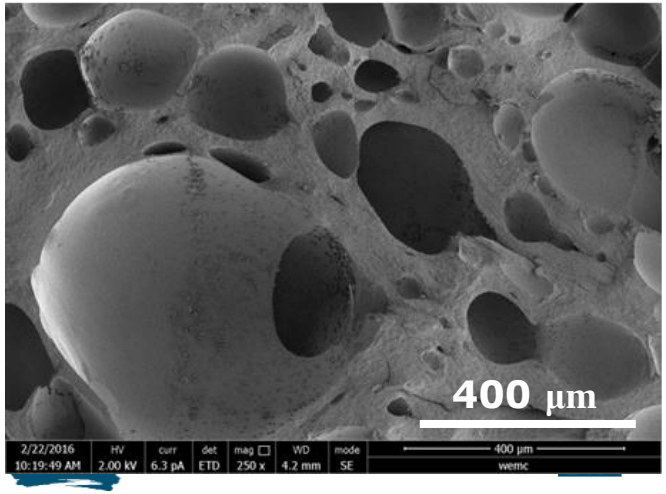
Tgse

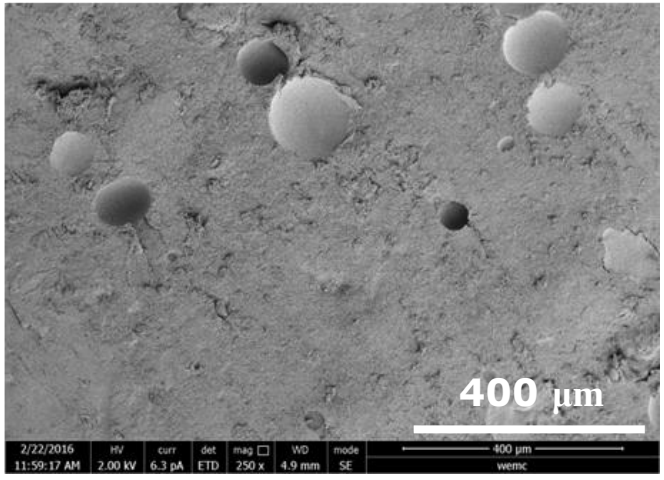
Alignment microscale

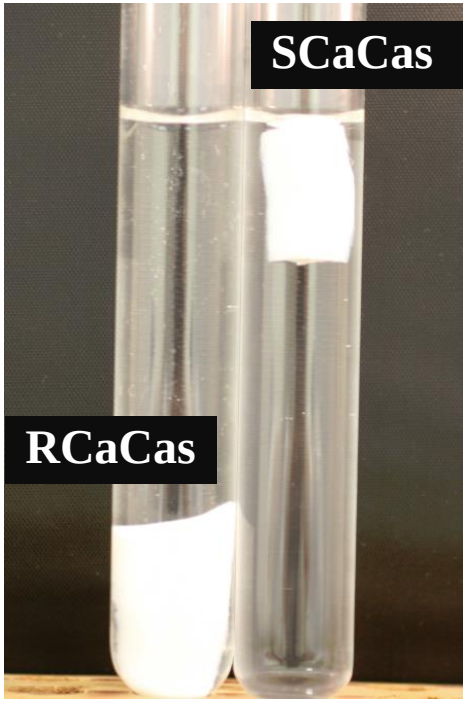




	Air(%,v/v)
SCaCas	26.8
RCaCas	12.7

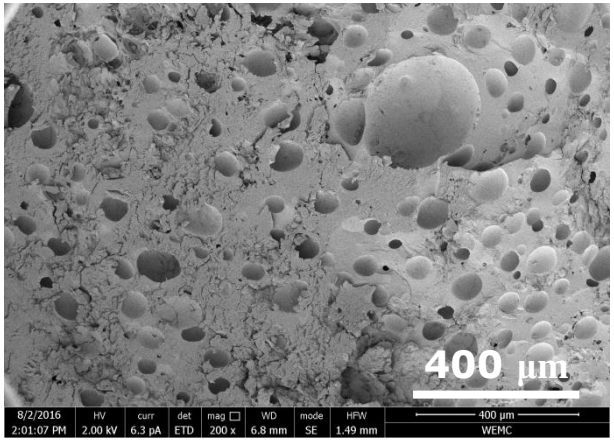




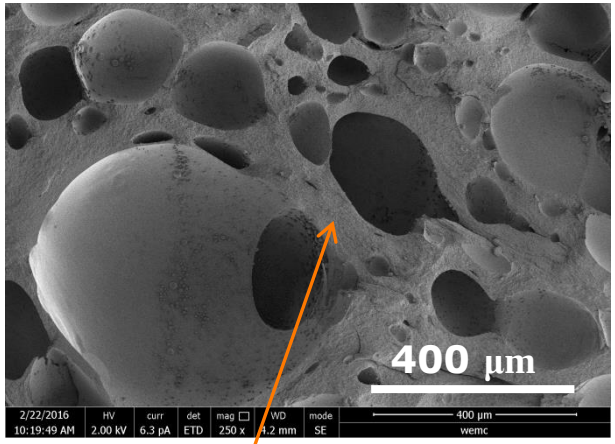


Alignment microscale

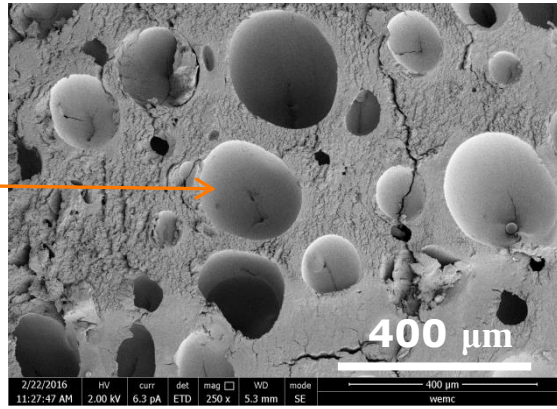
No shear

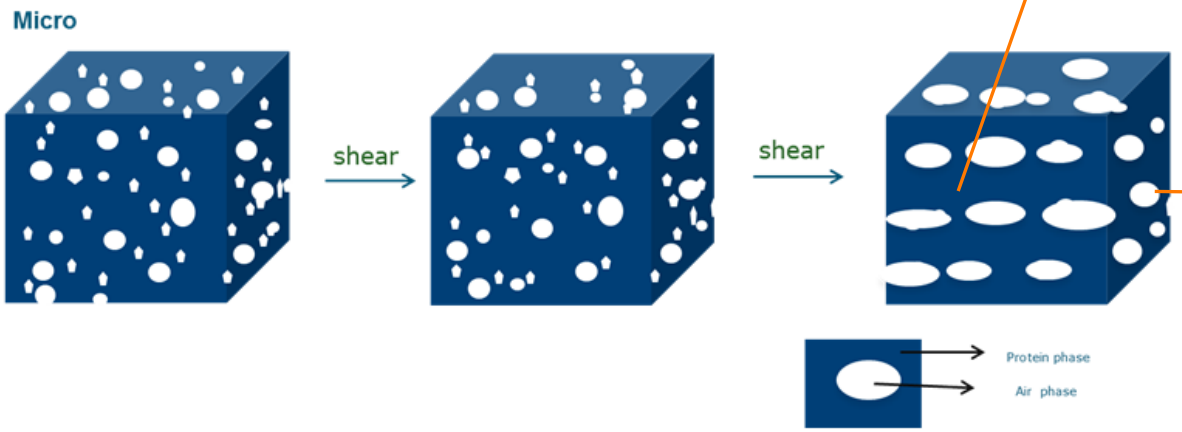


Parallel



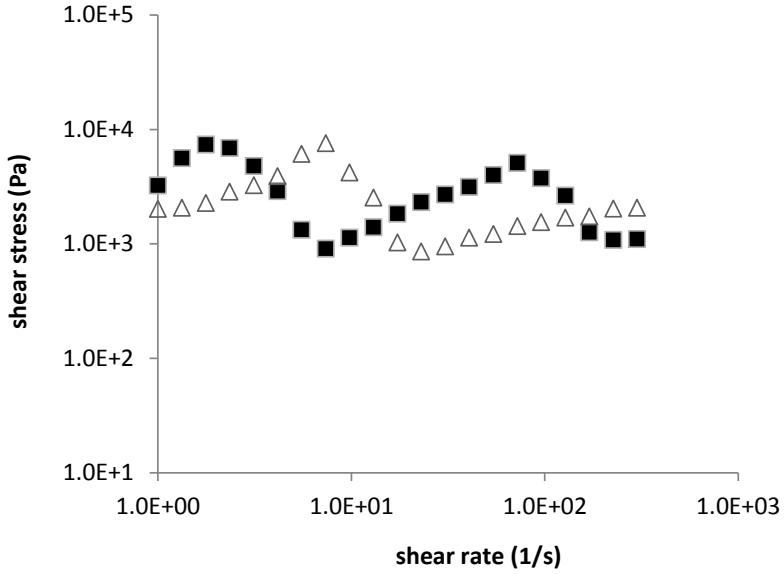
Perpendicular

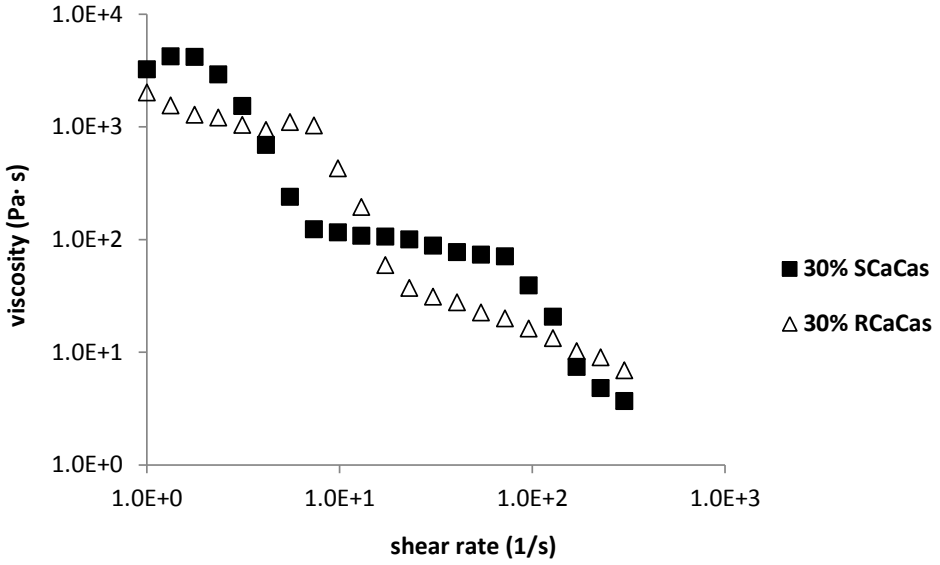




Rheological property

Non-monotonic





Take home message

- ❑ Air is a dispersed phase (weak phase) in fibrous structure. ⟶ arranged by shear flow resulting in high anisotropy index.
- ❑ The porous morphology of spray dried CaCas powder is needed

✓ On going research: factors influencing porosity arrangement

Thank you for listening!

Questions?

Contact:
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Acknowledgements

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