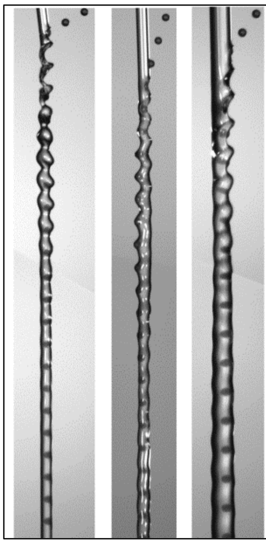
TECHNOLOGY OFFER

How to produce a regular arrangement of droplets of a first liquid in a continuous jet of a second liquid

This technology enables to encapsulate at least one material in a second one in the form of monodisperse spheres, regularly distributed along the axis of an infinitively long cylinder. The materials, initially two immiscible liquids, are assembled through capillarity and inertia. The structure is partially or totally hardened forming a microfiber with respectively liquid or solid inclusions. The fibres may be used for drug delivery, tissue engineering and smart materials production, especially textile.

BACKGROUND

Reliable encapsulation is crucial to protect fragile/potent actives and control their release or to enable the appropriate inclusion of functional materials. Highly regular spherical capsules can be obtained via microfluidics, but their manipulation necessary for dosing and distribution remains challenging due to the disperse character of such assemblies. On the other hand, bulk encapsulation does not offer the same level of control on the distribution and release, and to date fibres with inclusions have not shown the regularity required for most applications.



Three pictures showing droplets (dark liquid) of 200 µm diameter embedded in a continuous free flowing jet (clear liquid) with from left to right a diameter of:

- 300 µm,
- 400 µm,
- 600 µm.

TECHNOLOGY

The technology we offer combines the control, adjustability and regularity obtained for spherical capsules produced via microfluidics with the ease of capsule assemblies manipulation offered by fibres or bulk matrices. This ground breaking feature is obtained via the unique topology we produce, which consists in a free flowing continuous cylindrical jet containing spherical regular inclusions with a defined spatial periodicity. The production of this structure is achieved via the collision of at least one continuous stream of regular droplets with one cylindrical free flowing jet of another immiscible liquid. The droplet diameter, the droplet spacing and the jet diameter can be independently controlled and varied. The resulting structure can then be hardened, using state of the art principles such as solvent exchange, sol-gel transition, freezing. The hardening step can be performed on the liquid jet only, leaving the inclusions liquid, or on both materials. Advanced regular microfibers are obtained with high potential for drug delivery, tissue engineering, material and textile engineering.

ADVANTAGES

The proposed technology offers many advantages:

- Versatile process, adaptable to most liquid pairs and hardening techniques
- Inclusions are monodisperse, regularly distributed and mechanically connected
- Highly tunable and controllable products with independent adjustment of drop diameter, jet diameter and drop spacing
- Cylindrical, free flowing jet is obtained: no clogging, no interaction with channel walls or need for a third continuous phase, no constriction of the jet
- High inclusion throughput frequency (typically several 10 kHz)

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INVENTORS:
Planchette Carole
Brenn Günter
Hinterbichler Hannes

COOPERATION OPTIONS:
Licensing
Project
Sale

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Proof of principle

STATUS OF PATENTS:
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CONTACT:

Alexander Muhr
Graz University of Technology
Research & Technology House
Mandellstraße 9/II
8010 Graz
Austria
T: +43-(0)316-873 6924
alexander.muhr@tugraz.at
www.tugraz.at/go/ft-haus