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Project title: Solid water at room temperature – Cellulose fibrillar hydrogels with integrated fluidic channels

Author:
Rebecca Östmans[1,2], Tobias Benselfelt[1,3], Johan Erlandsson[1], Jowan Rostami[1], Stephen Hall[4], Stefan B. Lindström[5], Lars Wågberg[1,2]

Affiliation:
[1] Wallenberg Wood Science Centre (WWSC), 114 28 Stockholm, Sweden
[2] KTH Royal Institute of Technology, Department of Fiber and Polymer Technology, 114 28 Stockholm, Sweden
[3] NTU Nanyang Technological University, School of Materials Science and Engineering, 639798 Singapore, Singapore
[4] Lund University, Division of Solid Mechanics, Lund, Sweden
[5] FSCN Research Center, Mid Sweden University, 851 70 Sundsvall, Sweden

E-mail:
ostmans@kth.se

Abstract (approx. 200 words)**:**

To reach the EU goal of a fossil-free society by 2050, fossil-based materials urgently need to be replaced with renewable components. An excellent candidate for this is nanocellulose, due to its high availability and its highly desirable properties such as high stiffness, strength, and aspect ratio, making it a perfect building block in bio-based materials. However, a drawback with nanocellulose is the lack of fundamental understanding of its properties in the wet state, since it is highly hygroscopic and can retain large amounts of water.

Therefore, the aim of this research is to understand how nanocellulose particles can be handled and tailored in the wet state. To create self-supporting hydrogels containing as much as 99.9% of water, which we term solid water. The extremely low concentration of nanocellulose needed to create these hydrogels is the same as the solids content reached by diluting common seawater 350 times. We also demonstrate the utility of the extraordinary properties of this solid water by creating fluidic channels within the network to allow for directed fluid transportation in water. The understanding gained in this research project is of large importance for reaching the goal of a fossil-free EU by 2050.

Key words:
cellulose nanofibrils, fibrillar hydrogels, fluidic channels, colloidal gel, volume-spanning arrested state