

New Photonic Materials from Cellulose Nanocrystal Templating

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Complex supramolecular structures are abundant in nature. Spider silk and nacre, for example, are two natural materials whose impressive mechanical properties arise from their hierarchical structures. Inspired by these and other examples, chemists are turning to natural materials to construct new substances with fascinating properties.

Cellulose nanocrystals (CNCs) obtained from biomass self-assemble into a helicoidal arrangement that mimics the organization of mesogens in chiral nematic (cholesteric) liquid crystals.^[1,2] This organization can be used as a template to construct composite films of CNCs and other materials, such as silica^[3] (Figure 1) and polymers.^[4] By removing one component – either the CNCs or the matrix – one is left with a mesoporous film with a chiral nematic arrangement of holes.^[5]

In this talk, I will discuss our recent developments in this area, templating new materials with photonic properties.



Figure 1. Photograph of chiral nematic mesoporous silica films (source: reference 3). The coin is for scale.

References

- [1] Y. Habibi, L. A. Lucia, O. J. Rojas, *Chem. Rev.*, *110*, 3479-3500, **2010**.
- [2] J.-F. Revol, L. Godbout, D. G. Gray, *J. Pulp Pap. Sci.*, *24*, 146-149, **1998**.
- [3] K. E. Shopsowitz, H. Qi, W. Y. Hamad, M. J. MacLachlan, *Nature*, *468*, 422-425, **2010**.
- [4] M. K. Khan, A. Bsoul, K. Walus, W. Y. Hamad, M. J. MacLachlan, *Angew. Chem. Int. Ed.*, *54*, 4304-4308, **2015**.
- [5] M. Giese, L. K. Blusch, M. K. Khan, M. J. MacLachlan, *Angew. Chem. Int. Ed.* *54*, 2888-2910, **2015**.