Discovering new low-density polymorphs via negative pressure synthesis

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A pressing demand for new technologically important multifunctional materials is driving current research in materials science. As the properties of solids are intimately linked to their crystal structures, stabilising new metastable polymorphs of thermodynamically stable compounds is an appealing approach to extend the range of properties and applications of compounds. The discovery of novel methodologies to expand the range of accessible but as yet unknown polymorphs is thus an important asset for the development of new materials. Interestingly, recent crystal structure calculations predict that many metastable low density solids should be thermodynamically stable under moderate negative pressures [1, 2] and thus become viable synthesis targets. In this talk I will address the stabilisation of new low density metastable polymorphs upon creating tensile stresses on a liquid during crystal nucleation. To produce these conditions, one can exploit the adhesion forces on the liquids filling nanoporous materials which are exerted by the cavity walls [3]. The first results and challenges of exploring this approach to the syntehsis of new materials will be discussed.

References:

[1] J. Carrasco et al. *Phys. Rev. Lett.* **99**, 235502 (2007).

[2] Ž. Čančarević et al. *Chem. Asian J.* **3,** 561 (2008).

[3] K. Andrjanowicz et al. *Phys. Rev. Lett.* **105**, 265702 (2015).