of the Weyl points in the bulk as well as the Fermi arcs on the surface. Their results imply that the properties of WSM can be tuned by element substitution or surface doping, which encourages follow-up research to determine whether the shifting of Weyl points in momentum space or changes in the connection pattern of the Fermi arcs can manifest themselves in transport or optical properties. ❐

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ZEOLITES

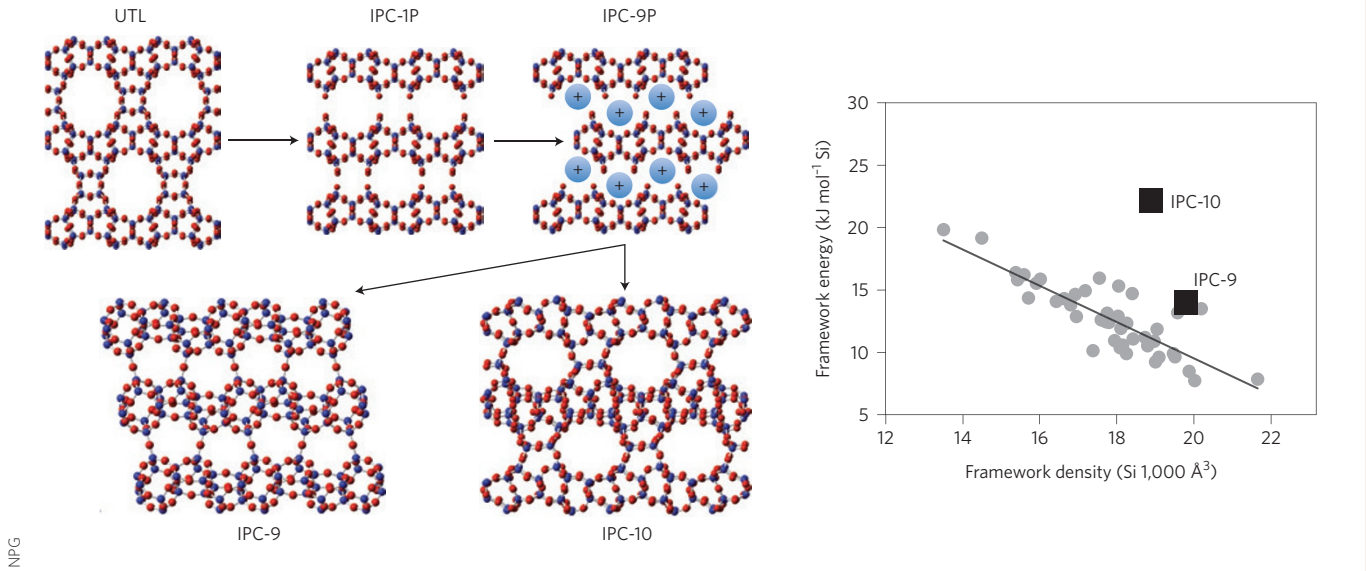
A synthetic solution

Chemists have had a hard time synthesizing novel zeolite frameworks. So far, approximately 200 different zeolite structures have been isolated, representing approximately 0.01% of the large number of structures that have been predicted to be possible. Studies have therefore been carried out to try and improve this meagre success rate by identifying among the predicted structures those that should be easiest to make. One measure of feasibility is to determine how well predicted zeolites compare to those known to be stable in terms of their framework densities and calculated energies. Another measure uses a set of structural rules for known zeolites to rule out frameworks that don't obey the same criteria. These models have suggested that a large number of hypothetical zeolites are synthetically inaccessible. Jiří Čejka, Russell Morris and their co-workers now highlight a flaw with this assumption (*Nature Chem.* http://doi.org/9hv; 2015). They reason that the common features displayed by known zeolite frameworks — and that underpin current feasibility models — may arise from kinetic limitations of the synthetic method (invariably being solvothermal synthesis) rather than from any fundamental features of the zeolite structures themselves.

To test this hypothesis, Čejka, Morris and co-authors tried a different synthetic method: assembly–disassembly–organization–reassembly. This is a top-down approach in which a parent zeolite structure is controllably dismantled such that the pieces formed can be reassembled (around a structure-directing agent, SDA) into a different framework. Importantly, unlike reversible solvothermal procedures, the irreversible nature of this method doesn't allow for the avoidance of higher-energy arrangements. The authors first disassembled a UTL zeolite into its constituent layers (IPC-1P; pictured, left). Then, through computational modelling they determined that by controlling the concentration of a choline cation SDA they could stagger the IPC-1P layers to form a new framework (IPC-9) after calcination. They also found that disordered silicon bridges between the layers could be introduced by adding dimethyldiethoxysilane to the reaction, giving rise to another structure (IPC-10).

Assessing the properties of these two new frameworks yielded some unexpected results. After calculating their framework energies, the authors found that IPC-9 resides at the edge of the energy–density space for known zeolites, and that the more disordered IPC-10 falls far outside of it (pictured, right). Moreover, neither framework fully adhered to the strict structural criteria used to describe known zeolites; in fact, both IPC-9 and IPC-10 would have been identified as unfeasible synthetic targets. These findings therefore suggest that modified synthetic approaches could be used to further expand the range of zeolite structures that can be isolated.

JAMES HENNESSY



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