Nano Wagon Wheels

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It looks like a tiny wagon wheel: Scanning tunneling microscope images published in the journal *Angewandte Chemie* depict giant molecules with a diameter of 7 nm, whose “hub”, “spokes”, and “rim” are clearly recognizable.

This unusual, highly symmetric structure was made by a team led by Sigurd Höger (University of Bonn); the pictures were taken by a Belgian team headed by Steven De Feyter (Kath. Univ. Leuven).

Two-dimensional particles, such as inorganic alumina platelets, are used as fillers for plastics because they impart excellent mechanical properties to these materials. Nanocomposites made of alumina platelets and polymers are thus extraordinarily rigid, strong, and thermally stable materials.

The barrier properties of plastics with respect to liquids and gasses, such as oxygen, could be improved by the addition of nanoscopic platelets. This would be useful for applications such as food packaging, and makes less expensive, more environmentally friendly plastics accessible.

To better understand the way in which the platelets work, several researchers have been working with synthetic alumina platelets. One area of interest is the use of large organic molecules in the form of rigid disks.

Their advantage: They can be produced with uniform shapes and sizes. Also, their chemical properties can be adjusted as needed by the

attachment of additional functional groups. Until now, organic molecular disks could not be made as large as the inorganic originals they are intended to imitate. The team from the Universities of Bonn and Leuven has now jumped this hurdle: They have successfully synthesized very large wheel-shaped molecules.

Starting from a rigid, star-shaped “hub”, the researchers added additional rigid molecular building blocks to form six “spokes”. Finally, the parts of the molecule were connected to form a continuous “rim”. The rigid linear molecules used contain aromatic six-membered rings as well as carbon–carbon triple bonds. Additional groups attached to the spokes provide the solubility required for the experiments to be carried out on these molecules.

In the next step, the researchers will attempt to grow these little wheels bit by bit by adding more building blocks onto the rim. This should result in structures resembling a spider web.

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