

For the First Time, a Five-Fold Bond

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Chemists at UC Davis have made the first stable compound with a five-fold bond between two metal atoms. The work with chromium could give researchers new insights into the nature of chemical bonding.

Much of chemistry is about understanding how bonds are made and broken. For most of the history of chemistry, only single, double or triple bonds were known. Multiple bonds are particularly important in carbon chemistry, but only certain metals are theoretically capable of more than triple bonds, said Philip Power, professor of chemistry at UC Davis and senior author on the paper.

The dark red crystals were synthesized by Tailuan (Peter) Nguyen, a graduate student in Power's laboratory. The chromium-based compound is stable at room temperature but decomposes in the presence of water, and spontaneously ignites when exposed to air.

To make the compound, Nguyen and Power attached large carbon-based molecules to chromium atoms, constraining how they could behave. They were then able to coax the chromium atoms to bond with each other. The multiple bonding was confirmed by X-ray crystallography and magnetic measurements.

As far as we know, no comparable compound exists in nature, Power said.

In addition to Nguyen and Power, other authors on the paper were postdoctoral researcher Andrew Sutton, theorist Marcin Brynda and

crystallographer James Fettinger at the UC Davis chemistry department; and Gary Long, professor of chemistry at the University of Missouri, Rolla. Peter Klavins and Long Pham at the UC Davis physics department carried out magnetic measurements for the study.

The work is published online in Science Express and will appear in the print version of the journal Science later this year.

Source: UC Davis

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