

# Indian researchers solve a long-standing puzzle – in chemistry

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Prof Sundargopal Ghosh, Department of Chemistry, IIT Madras, at an instrument lab in the campus. (Photo Credit: Special Arrangement)

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Researchers at IIT Madras and Indian Institute of Science, Bengaluru, have achieved a major chemistry breakthrough by synthesizing a new carbon-free molecule that copies the unusual

'sandwich' structure of the famous carbon-containing ferrocene molecule, solving a problem that had challenged scientists for over seven decades.

Ferrocene, discovered in the early 1950s, is a widely used compound in a variety of modern technologies, whose unique structure — an iron atom 'sandwiched' between two large and flat carbon ringed-molecules — has attracted a lot of scientific interest. It is used in medicines, batteries, advanced materials and electronics. For decades, scientists have tried to create similarly structured-molecules with elements other than carbon, but could not succeed.

Carbon has a special place in chemistry. There is a whole branch of chemistry, called organic chemistry, dedicated to study of carbon and its compounds. Carbon very efficiently combines itself and other elements to form very stable large and complex molecules. Scientists have been interested in finding whether the special structure of ferrocene was only because of the involvement of carbon rings, or could other elements also form similar sandwiched structures between themselves.

Scientists around the world had tried different combinations but a truly carbon-free molecule with a similar structure and stability could not be synthesized.

Now, a group of researchers at IIT Madras led by Sundargopal Ghosh and Stutee Mohapatra, in collaboration with Eluvathingal Jemmis of Indian Institute of Science, [Bengaluru](#), has managed to do exactly that. They have designed a new molecule which has osmium at the centre instead of iron, sandwiched between two boron-based rings, instead of carbon rings. The structure is very similar to that of ferrocene but is entirely carbon-free.

The discovery has been reported in Science journal, one of the world's most prestigious scientific publications.

Right now, the discovery is being seen mainly as an academic breakthrough. Its potential applications are still being investigated.

"It is a fundamental breakthrough of great interest. It answers a question that scientists had been interested in for very long. It does open new possibilities for designing novel materials that can have special properties. Those possibilities are still being explored," Ghosh told The Indian Express.

Initial investigations have revealed that the new molecule is structurally stable, and the bonding between osmium and boron rings is very strong, which could make it potentially more robust than ferrocene.

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