

IIT Indore Develops Sustainable Micro-Plasma Metal 3D Printing Technology to Revolutionize Metal Additive Manufacturing for Industry

Researchers at IIT Indore have developed a revolutionary new metal 3D printing technology that promises to change the way industries create metal parts — making the process greener, more affordable, and more versatile.

Led by Professor Neelesh Kumar Jain, faculty at IIT Indore, the team comprising of Dr. Mayur Sudhakar Sawant and Dr. Pankaj Kumar, has introduced **μ-plasma metal additive manufacturing (μP-MAM)**, a cutting-edge method that uses a special form of plasma (ionized gas) to print high-quality metal components layer by layer. Unlike traditional metal 3D printing techniques, this new technology uses much less electricity and does not emit harmful gases, making it a sustainable choice for industries like aerospace, defence, healthcare, and tooling.

The innovative process works with a variety of metals, including titanium alloys used in aircraft, special materials for medical implants, and superalloys for heavy-duty tools. It is supported by a specially designed 5-axis CNC machine, which can handle different types of metal feedstock in powder or wire form — offering unmatched flexibility in manufacturing.

This technology fills a crucial gap between existing 3D printing methods and older welding techniques, delivering precise, efficient, and eco-friendly metal parts at a meso-scale level (medium-sized parts). It has already been patented in India and recognized with IIT Indore's Best Technology Award.

Professor Suhas Joshi, Director of IIT Indore, added, "This breakthrough reflects IIT Indore's commitment to innovation that benefits society and industry. μP-MAM positions India as a leader in advanced, eco-friendly metal 3D printing."

"Our new technology cuts down on energy use and pollution while making it easier and cheaper to create complex metal parts. This means faster production, lower costs, and less harm to the environment," said Professor Neelesh Kumar Jain. "In future, we are planning to develop digital twin of the process, preparing it for widespread commercial use in coatings, cladding, and aeronautical manufacturing."