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Mitsubishi Electric's New Fiber-laser Welding Technology Dramatically Reduces Spatter for Faster Welding

Raises the welding quality and productivity of high-power fiber-laser welding for industrial applications

TOKYO, May 17, 2018 – Mitsubishi Electric Corporation (TOKYO: 6503) and its affiliate company Tada Electric Co. announced today their joint development of a new fiber-laser welding technology that cuts flying molten metal (spatter) by 95 percent or more*. Whereas conventional spatter levels can lower the quality and speed of fiber-laser welding, the new low-spatter technology raises the welding quality and productivity of high-power fiber-laser welding for industrial applications such as steel processing, automobile production and electrical equipment installations. The new technology is expected to be incorporated in laser-welding machines that will appear in 2019.

*Compared with conventional technology during welding using SPHC (hot rolled material)

Conventional technology | Newly developed technology

Fig. 1. Visual comparison of spatter during fiber-laser welding

Key Features

1) ***Combined high/low-power laser beam reduces spatter by 95 percent or more for improved welding quality***

- Suppresses spatter regardless of welding speed by irradiating a low-power laser beam around the high-power laser beam.
- New optical system simultaneously generates high-power and low-power laser beams from the output beam of feeding fiber.
- 10-kW high-power fiber laser cuts spatter by 95 percent or more for improved weld quality.

In laser welding, a deep penetration hole and a molten metal pool are formed in the area irradiated with the laser beam. Laser power can be raised for deeper penetration, but this can generate excessive spatter. Mitsubishi Electric and Tada Electric, after studying molten pools under a variety of welding conditions, conducting more than 10,000 experiments with a high-speed camera, discovered that spatter could be greatly suppressed by irradiating a low-power laser beam around the high-power beam. Later, using a newly developed optical beam-forming system installed at the output end of the optical fiber, a low-power laser was irradiated simultaneously around a high-power laser focused on the same point (Fig. 2.). Testing with a 10-kW high-power fiber laser confirmed that spatter could be reduced by more than 95 percent compared with a conventional system working at the same welding speed (Fig. 3).

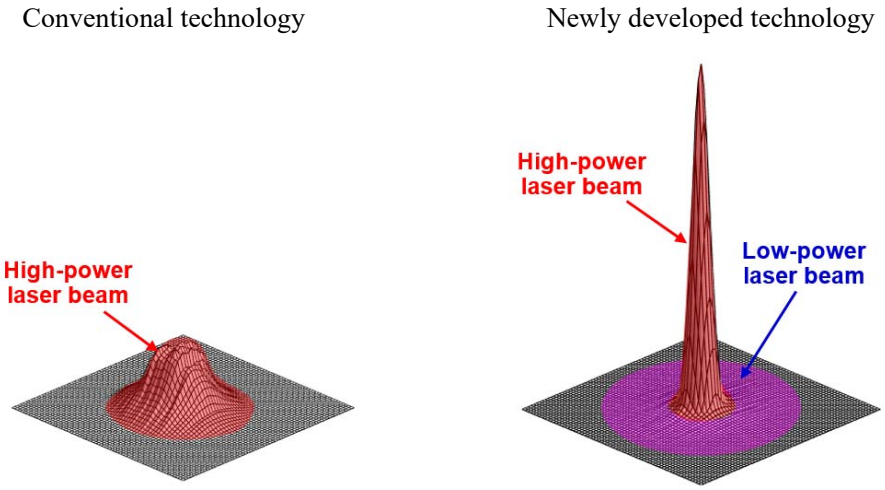

Fig. 2. Comparison of light-intensity distribution of focused laser beams

2) ***Doubles the speed of welding by suppressing spatter, contributes to increase in productivity***

- Welding speed does not need to be lowered to suppress spatter, so the system's 10-kW high-power fiber laser can weld at twice the speed of a conventional system when welding material of the same thickness.

In conventional fiber-laser welding, spatter increases remarkably at certain welding speeds, requiring the speed to be lowered to ensure welding quality. However, using the technology announced today when raising the welding speed increases spatter only minimally, allowing for the full benefits of the laser's power to be utilized. In a test using SPHC (hot rolled material) with a thickness of 4.5 millimeters, the new technology's welding speed was double that of a conventional welding process (Fig. 3).

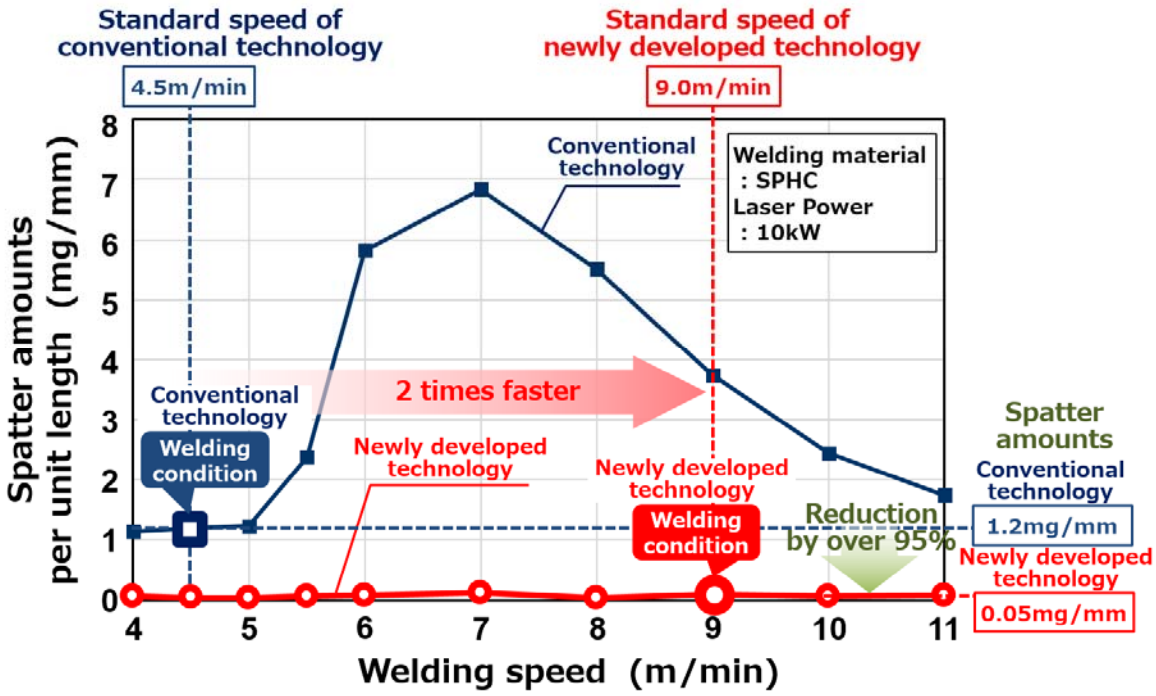

Fig. 3. Comparison of spatter amounts

Background

CO_2 lasers have been used in laser welding machines, but fiber lasers have been gaining popularity due to their low-power consumption combined with easy operation and maintenance. Conventional fiber-laser welding, however, generates much spatter and has problems with decreased weld thicknesses and spatter adhering to material surfaces. In addition, suppressing spatter requires the welding speed to be lowered, resulting in lower productivity.

Roles in Joint Development

Mitsubishi Electric handled the research and development of laser welding technology and related optical technology, while Tada Electric handled the development of the laser-welding machines and systems and conducted the laser-welding tests and evaluation.

Patents

Pending patents for the technology announced in this news release number one in Japan.

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About Mitsubishi Electric Corporation

With nearly 100 years of experience in providing reliable, high-quality products, Mitsubishi Electric Corporation (TOKYO: 6503) is a recognized world leader in the manufacture, marketing and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation and building equipment. Embracing the spirit of its corporate statement, Changes for the Better, and its environmental statement, Eco Changes, Mitsubishi Electric endeavors to be a global, leading green company, enriching society with technology. The company recorded consolidated group sales of 4,431.1 billion yen (US$ 41.8 billion*) in the fiscal year ended March 31, 2018. For more information visit:
www.MitsubishiElectric.com

*At an exchange rate of 106 yen to the US dollar, the rate given by the Tokyo Foreign Exchange Market on March 31, 2018

About Tada Electric Co., Ltd.

Tada Electric is engaged in the manufacture and sale of cooling equipment for electric power equipment, various heat exchangers, environmental equipment, laser/resistance welding machines, and electron-beam welding machines. The company is based in Amagasaki, Hyogo Prefecture, Japan and headed by President Tsutomu Sugiyama. Please visit http://www.tadadenki.jp.