LASER WELDING

Fig. 1

Introduction:

Laser Beam Welding (LBW) is a high energy beam process that continues to expand into modern industries and new applications because of its many advantages like deep weld penetration and minimizing heat inputs.

Major Difference:

The most important difference between traditional electric arc welding processes and laser beam welding is in the mode of energy transfer. Unlike electric arc energy transfer, laser energy absorption by a material is affected by many factors like the type of the laser, the incident power density and the base metal's surface condition.

Two important factors to help characterizing laser welding are:

1- The energy transfer efficiency, which is the ratio of the heat absorbed by the workpiece to the incident laser energy.

2- The melting efficiency, which is the ratio of the heat to just melt the fusion zone to the heat absorbed by the workpiece.

The laser output is not electrical, does not require electrical continuity, is not influenced by magnetism, is not limited to electrically conductive materials, can interact with any material and its function doesn't require a vacuum nor does it produce x-rays.

How it works:

The focal spot is targeted on the workpiece surface which will be welded. At the surface the large concentration of light energy is converted into thermal energy. The surface of the workpiece starts melting and progresses through it by surface conductivity. For welding, the beam energy is maintained below the vaporization temperature of the workpiece material.
Because the penetration of the workpiece depends on conducted heat, the thickness of the materials to be welded is generally less than 20 mm if the ideal metallurgical and physical characteristics of laser welding must be realized.

Concentrated energy produces melting and coalescence before a heat affected zone is developed and when the materials to be welded are thick and have high thermal conductivity the advantage of having a minimal heat affected zone is significant.

Fig. 2

Fig. 3

Industries Served:

1- Aerospace.
2- Defense/military.
3- Electronics.
4- Research & development.
5- Medical.
6- Sensors & instrumentation.
7- Petrochemical refining.
8- Communications & energy.

Advantages:

be done.
created.
3-Minimal heat affected zones in welds created.
4-Excellent metallurgical quality will be established in welds.
5-Ability to weld smaller, thinner components.
6-Increased travel speeds.
7-Non-contact welding.

Fig. 4

1-Deep and narrow welds can
2-Absence of distortion in welds

Fig. 5

References:

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- www.ieee.com
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