between Austenitic Stainless Steel **(**ASS) and Ferritic Stainless Steel **(**FSS) is usually carried out by GTAW with type 309 SS filler to avoid formation of hard and brittle martensite and to produce a ductile austenitic weld metal (WM). However, the problem of extensive grain coarsening on FSS side, due to its higher diffusivity, cannot be avoided. The problem becomes more acute in thin sheet DMW, where no filler can be used.

The present micro structural study had been undertaken with the objective to produce ductile autogeneous laser butt weld between type 304 ASS and stabilized 17% Cr ferritic SS. The microstructure of WM was favorably engineered by preferential displacement of focused laser beam towards ASS side. LW effectively reduced the extent of heat-affected zone, especially in ferritic SS. In contrast to coarse-grained micro-structure of the autogeneous GTA weld with large blocks of ferrite and martensite/retained austenite, LW produce highly refined microstructure in the WM. Largely austenitic WM was achieved by the use of nitrogen as the shroud gas. Fig. L.13.1 shows change in WM microstructure with different welding parameters. [R. Kaul, P. Ganesh and A. K. Nath, J. of Laser Applications 17(1), 2005].

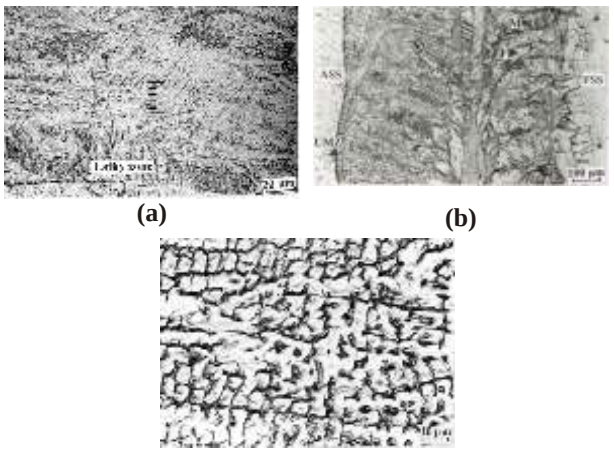

Fig L.13.1 *Microstructure of LWM produced by, (a) focused laser beam at the center, (b) preferentially displaced focused laser beam towards ASS side (c) preferentially displaced focused laser beam towards ASS side with nitrogen as the shroud gas*

(Contributed by: A.K. Nath; aknath@cat.ernet.in)

L.14 Laser Rapid Manufacturing

Laser rapid manufacturing (LRM) is a new class of technology used for fabricating engineering components by direct deposition of metal powder according to 3D computer-aided design (CAD) data. Unlike CNC machines tools, which are subtractive in nature, RM systems fuse together metal powder to form complex parts. This is basically an extension of the laser cladding to three-dimensional deposition and a promising technology for low volume manufacturing.

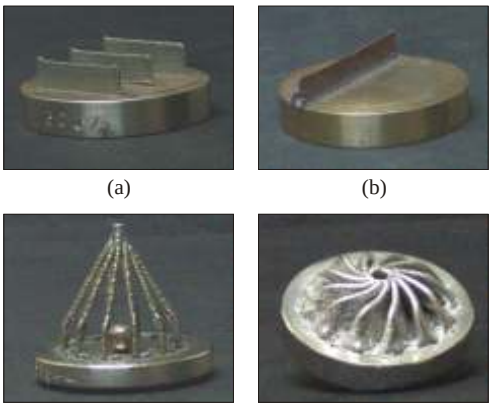

Fig L.14 (a) SS316L walls of different thickness (0.8-1.2mm) on SS304L substrate, (b) Cu wall over SS304L substrate, (c) Cage and (d) Impeller

A LRM facility has been set up integrating the indigenously developed 3.5kW CW CO_2 laser with an in-house developed co-axial powder feeding system and a 5-axis CNC machine. The powder feeder can feed the SS316L metal powder from 2 g/min to 30 g/min with a 0.2g/min increment. A number engineering components of simple geometry have been fabricated, using SS316L, Inconel-625, Colmonoy-6, Cu powders over SS304L substrate. The fabricated components have dimensional accuracy about 100 microns and surface finish 5-7 Ra value for SS316L material. LRM deposited material has demonstrated high tensile properties with low ductility for SS316L and Inconel-625.

(Contributed by: A.K. Nath; aknath@cat.ernet.in)

L.15 Quest for magnetic materials for newer technology

We are carrying out detailed experimental work (e.g., magnetization, magnetotransport, etc.) on the intermetallic compound Gd_5Ge_4 probing the FOMST and the different magnetic phases in the compound.

Gd_5Ge_4 is the parent compound of the $Gd_5(Ge_{1-x}Si_x)_4$ series. This series of compounds is under intense experimental study worldwide, in connection with the phenomena of giant magnetocaloric effect, giant magnetoresistance, and colossal magnetostriction. All these phenomena are due to simultaneous magnetic and crystallographic (Martensitic)