The changes observed in the absorption and emission spectra of the drug on addition of liposomes were considerably larger at pH 5.0 than at higher pH investigated (6.0 and 7.4). At pH 5.0, with increasing lipid concentration, first a decrease was observed in the emission intensity of the 660 nm band dominant in the drug emission in neat buffer. At higher lipid concentration, fluorescence intensity increased with the dominant band shifting to ~ 680 nm (fig. L.12.1a). These observations are consistent with the fact that the neutral species of the drug abundant at low pH will bend strongly enough even at low lipid concentration, and suggest that, as a consequence, the amount of drug per liposome increases up to such an extent that self quenching of fluorescence occurs. This effect gets reduced as the pH of the medium is increased, as increased pH produces more anionic species, and since they are less hydrophobic than the neutral ones, the binding with the liposomes becomes less favorable and consequently the self-quenching of fluorescence in the lipid bilayer decreases.

To further confirm these aspects we measured the pH dependence of the fluorescence decay time of the drug for varying lipid concentration. The results in fig. L.12. 1b show that for a given concentration of the drug, at pH 5.0 the fluorescence decay was faster for liposome concentrations where the fluorescence quenching was observed to be significant and was slower at larger liposome concentrations. For higher pH the dependence of the decay times on concentration of liposomes was much smaller. Similarly fluorescence quenching experiments with iodide ions confirmed that while at pH 5.0 the drug bound to liposome is inaccessible to the quencher and hence located deep inside the lipid bilayer, for pH 6.0 and higher where the anionic species are a majority, the drug binds closer to the liposome interface. [For details see: *K. Das, B. Jain, A. Dube and P.K. Gupta, Chemical Physics Letters, Vol. 401, page 185-188, (2005)*].

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L.13 Laser welding of automobile transmission gear assemblies

Laser welding of automobile transmission gear assemblies has been established. In the first phase of the study, a few gear assembly blanks were laser welded using the indigenously developed high power continuous wave CO_2 laser, and mechanical and metallurgical characterizations were carried out. Good quality weld, up to 4 mm depth, with narrow heat affected zone was produced at 2.5-3 kW laser power and 1mm/min weld speed. Argon gas was used as a shielding gas during laser welding. Mechanical strength of the weld joint confirmed the specifications.

Fig. L.13.1 *Laser welded gear assemblies*

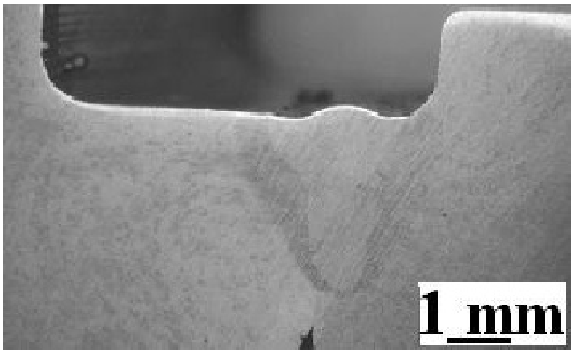

Fig. L.13.2 *Macroscopic view of Laser weldment cross-section*

In the second phase, about 230 numbers of different kinds of automobile transmission gear assemblies were laser welded for functional testing. Fig. L.13.1 presents photographs of laser welded gear assemblies, while fig. L.13.2 show a macroscopic view of the cross-section and close up of one of the laser weldments respectively.

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L.14 Improved mechanical properties of Inconel-625 components by laser rapid manufacturing

Laser rapid manufacturing (LRM) is an upcoming rapid manufacturing technology, being developed at the various laboratories around the world. It is similar to laser cladding at process level with different end applications. In general, laser cladding technique is used to deposit material on the substrate, either to improve the surface properties or to refurbish the worn out parts, while LRM is capable of near net shaping the components by layer-by-layer deposition of the material directly from CAD model.