L.3: Development of 18 kHz dye laser pumped by DPSSL

High pulse repetition rate (PRR) tunable dye lasers offer a unique combination of wavelength tunability and narrow linewidth, which is required for spectroscopy applications. The high PRR tunable dye lasers are obtained by optically pumping the dye solution flowing through a dye cell. For the dye flow a closed loop dye circulation/cooling system is used. The diode pumped solid state green lasers (DPSSL) are rapidly emerging as a pump source for high repetition rate dye lasers. In view of this, a high repetition rate (18 kHz) narrow linewidth dye laser pumped by DPSSL has been developed in LSED.

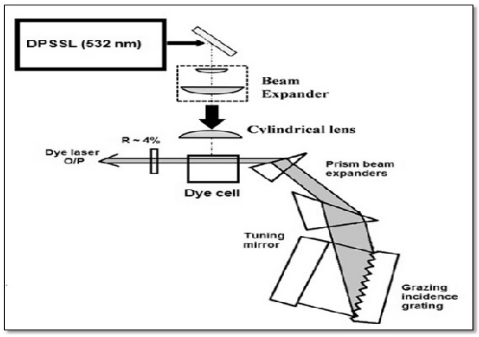

Fig. L.3.1: Schematic of dye laser pumped by DPSSL

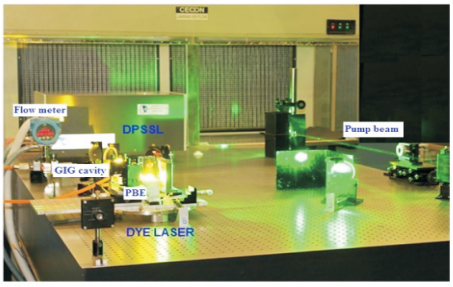

Fig. L.3.2: Photograph of the dye laser system

Figure L.3.1illustrates the schematic of the dye laser system pumped by DPSSL and Fig L.3.2 shows the photograph of the experimental system. The dye cell was made up of high quality BK-7 optical glass having dimensions 0.7 mm (gap) × 10 mm (height) ×15mm(width). The dye laser oscillator had grazing incidence grating (GIG) based optical resonator which consisted of a 4% output coupler wedge, intra-cavity double prism beam expander (M~ 22 at angle of incidence ~80°), a grating (groove spacing ~2400 l/mm) and a high reflectivity tuning mirror (R > 99%). DPSSL operating at 18 kHz with ~9 W average output power and ~125 ns pulse width (FWHM) was used to transversely pump the dye laser. The study was carried out with 1mM solution of laser grade dye Rh-6G dye in ethanol, flowing through the dye cell. Dye laser output parameters namely, power and linewidth were studied with variation of dye solution flow rate (1 to 11 LPM). In-house developed dye flow system was used to control the flow rate of the dye solution. The dye laser output power, tuning range and its linewidth were measured with the help of laser power meter and High Finesse wavelength meter respectively. The variations of parameters are shown in Fig. L.3.3. The optimized output power and linewidth (at λ ~580 nm) were ~550 mW and ~2GHz respectively. The pulse shapes of DPSSL (FWHM ~125 ns) and dye laser (FWHM ~75 ns) recorded on DSO are shown in Fig.L.3.4.

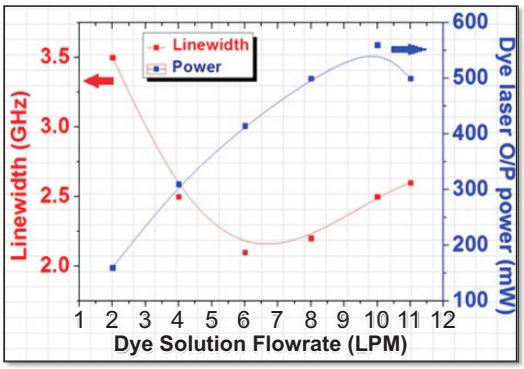

Fig. L.3.3: Linewidth and output power

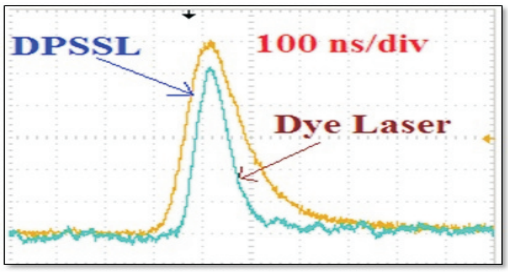

Fig. L.3.4:Pulse shape of DPSSL and Dye laser

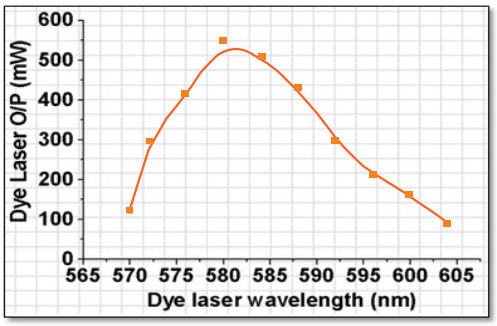

Fig. L.3.5:Tuning range of DPSSL pumped dye laser

The tuning range of dye laser (Fig.L.3.5) was ~35 nm which could be tuned from ~570 to 605 nm.

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