§18. Development of Far-Infrared Lasers for LHD Diagnostics

Okajima, S.(Chubu Univ.), Kawahata, K.,
Ejiri, A.(Tokyo Univ.), Tanaka, K., Ito, Y.

For LHD diagnostics, we have developed powerful and stable 119-μm CH_3OH laser pumped by 9P(36) cw CO_2 laser as the source of multichannel laser interferometer [1,2]. For the higher density operations of LHD, short wavelength FIR (Far Infrared) lasers of 40- to 100-μm range may be useful rather than the long wavelength FIR lasers mentioned above and 10-μm CO_2 laser from the view points of refraction and vibration effects and fringe shifts in the interferometer. In order to develop the laser source, new FIR laser system, which can equip the laser tube of 25 to 54 mm in diameter and 2 to 3 m in length, has been constructed.

For the sources, the characteristics of CH_3OH, CD_3OH, CH_2DOH, CH_3OD and NH_3 lasers have been measured [3-5]. Table 1 shows the powerful CH_3OD lasers obtained by 2 m laser as an example. From the results, 71-μm CH_3OH laser (65 mW) [3], 57-μm CH_3OD laser (65 mW) (Fig.1) and 67-μm NH_3 laser (43 mW) [5] will be useful for the future plans of LHD diagnostics.

On the FIR detector, GaAs Schottky barrier diode (SBD) is useful, because of low noise and high sesitivity at room temperature. In order to know the characteristics of the diode detector for short wavelength FIR light, we have tried the detection of 57-μm (5.2 THz) CH_3OD laser output using an 119-μm (2.5 THz) SBD detector. Figure 2 shows a typical example of the video signal.

The optimizations of the laser cavity and the detector are proceeding now.

References
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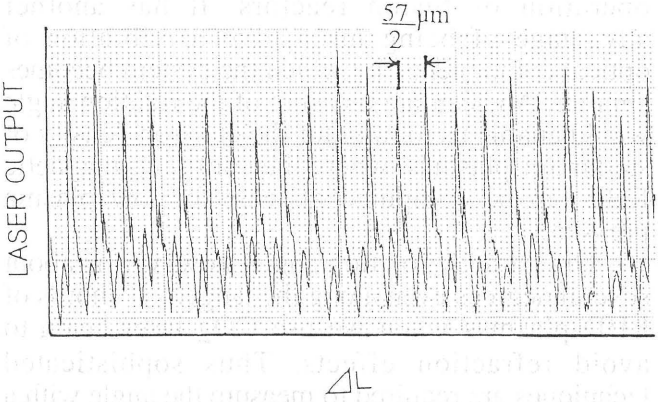

Fig.1. Detuning curve of 57-μm CH_3OD laser pumped by 9R(8) cw CO_2 laser.

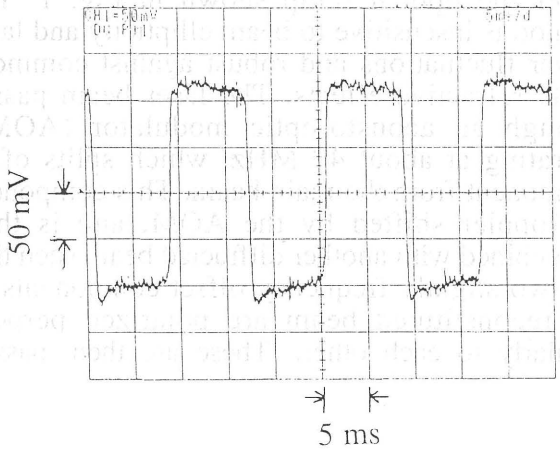

Fig.2. Video signal of 57-μm CH_3OD laser (5.2 THz) output detected by SBD.

Table 1 Powerful CH_3OD lasers pumped by cw CO_2 laser.

CO_2 laser		FIR laser				
line	power(W)	molecule	wavelength(μm)	pol.	pressure(torr)	power(mW)
9P(10)	86	CH_3OD	133	∥	0.27	3
9P(26)	85	CH_3OD	117	∥	0.3	26
9P(30)	84	CH_3OD	103	⊥	0.32	23
9R(8)	64	CH_3OD	57	⊥	0.26	65