§5. Remote Sensing of Density of Carbon Dioxide by LIDAR

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LIDAR (Light Detection And Ranging) is a potentially attractive avenue for remote sensing of carbon dioxide. A nitrogen laser is favorable for its eye safety radiation. An axially pumped compact nitrogen laser is developed for a LIDAR. As shown in Fig. 1, the discharge tube has a pair of electrodes and quartz windows on the both ends. An aluminum mirror R=85% is used for an end mirror. Nitrogen gas flow around 0.3 l/min is supplied from a N₂ tank. Fig.2 shows the its electronic circuit designed for a low-voltage battery.

The length and inner diameter of discharge tube is experimentally optimized for small beam divergence. The nitrogen gas pressure also optimized for high output energy. The results are plotted in Fig.3. The length of 150mm, inner radius of 2.5mm and pressure of 1kPa are decided as optimum values for this laser additional consideration of stable operation.

As shown in Fig.4, the LIDAR was composed of the nitrogen laser, a Newtonian telescope (f=500mm), a spectrometer (Koukenkouyou, SG-80, 0.7mm resolution), a photomultiplier (Hamamatsu, E717-74), and photon counter ( ORTEC, MCS-PCI). The spectrometer is tuned around 1285.5 cm⁻¹ for separation from the Raman shift of N₂O.