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CO₂ Leak detection for CCS plants by Infrared laser

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1. Introduction

Recently, serious effects on the environment caused by global warming are concerned. In the recent research, the relationship between global warming and increase in atmospheric concentrations of CO₂ by massive emissions of them from fossil fuel combustion and other human has been shown. Suppression of increasing concentrations of CO₂, the Kyoto Protocol was concluded that to reduce emissions. CO₂ reduction efforts have been made by countries around the world based on developed countries.

Under these conditions, the technology of Carbon Capture and Storage (CCS) into underground or underwater has been studied. CCS is a method considered to reduce emissions by immobilizing of CO₂ and eliminate the environmental impact. In the future, the possibility that CO₂ could be required to collect in the large scale facility for CO₂ emission such as boilers is very high because of more stringent CO₂ emissions regulations.

In other way, in these processes means of monitoring equipment is required in terms of safety and environmental disclosure (see Figure 1). Especially because the storage facility is large area, pinpoint measurements by the detector, such as the conventional sampling and continuous monitoring is difficult. CO₂ leakage detector, using laser remote sensing that can be observed has been extensively studied whether some cases. However, it is not a practical step-to-use devices because they are large and complex system and costs a several hundred thousands to million \$. These devices are intended for use in any sophisticated measurement. To consider the evolution of such devices we seek an extension of this concept is difficult. By the new device concepts, research and development of practical and affordable equipment, it is necessary to provide the end user.

Measurement of CO₂ concentration can be realized by using the many absorption spectra in the infrared light region (2 μ m, for example). Infrared measurement technology has the potential of a wide variety of applications including environmental and energy security but the commercialization of them has been delayed compared to other wavelengths region. On the other hand, by the increasing amount of activation in the past few years, and in the near future are expected to be star of practical development.

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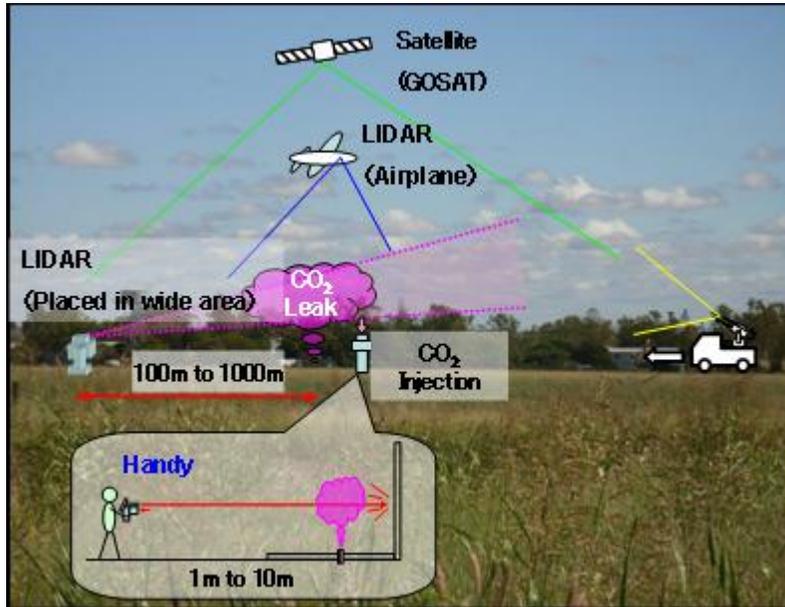


Fig.1 Application of CO2 measurement technique to CCS plants.

2. Basic Concept of CO2 monitoring

In this study, we are developing the remote measurement system of CO2 leak detection by infrared light source. Outline of the measurement system is shown in Figure 2. Measurement area is irradiated with infrared light by the infrared light source and scattered by some targets such as dust in the air, trees, or the ground and the scattered light is detected by the detector near the light source. In case that the wavelength of infrared light matched to CO2 absorption wavelength, the light is absorbed by CO2 present in the area and the power of the light is attenuated. By comparison to the power of the reference light to be not absorbed by CO2, the concentration of CO2 can be determined. If CO2 is leaking, high concentrations of CO2 leakage can be detected by increased attenuation.

In the presentation, we will report the concept of the system, estimation of the system performance by calculations, and the measurement results in the room and outside, using prototype of the system.

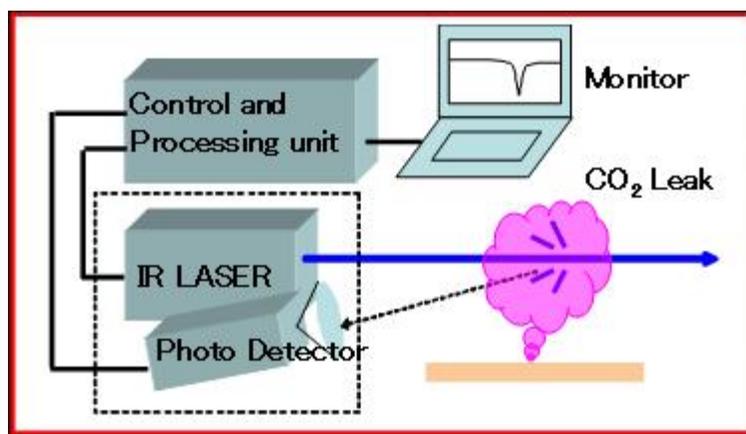


Fig.2 Basic diagram of CO2 leak detection system by infrared light.