Development of a Non-Destructive Remote Sensing Technique for Remaining Fluorocarbons in Insulation by Photothermal Radiometry

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Fluorocarbons remaining in building insulation have much effect on ozone depletion and global warming. The amount of remaining fluorocarbons in insulation changes depending on the working temperature of the insulation, and each of the insulations has a different amount remaining. For effective treatment, it is necessary to collect remaining fluorocarbons according to the amount remaining. Therefore, an evaluation method which handily measures the amount of remaining fluorocarbon in situ is needed. Remaining fluorocarbons in insulation is replaced by air as time passes. Since the thermal diffusivity of a fluorocarbon is significantly different from that of air, the increase in the thermal diffusivity of the insulation with the decrease of the remaining fluorocarbons is detectable. In the present study, we have focused our attention on the relation between the gas composition and the thermal diffusivity of insulation, and the aim of this study is to develop a non-destructive remote sensing technique for remaining fluorocarbons in insulation. We have suggested applying photothermal radiometry (PTR) to the evaluation.

In PTR, when a sample is heated by a modulated laser light, periodic temperature variation generates thermal radiation from the sample surface. As a detector, photoselective film is set in front of the sample. Using a photoselective film which transmits or absorbs light depending on the incident wavelength, the thermal conductivity and thermal diffusivity of the sample can be obtained from the analysis of phase-lag between the thermal radiation and the heating light. This measurement uses light application, and therefore PTR is a non-destructive method of evaluation.

Using borosilicate glass as the photoselective film, we have measured several polystyrene foams containing known amounts of fluorocarbons (1.2~2.1% wt CFC-12 and 4.1% wt HCFC-142b). The results have shown the feasibility of in situ measurements of the amount of fluorocarbons in insulation by PTR.