

## Novel noncontact measurement method of combustion gas using X-rays

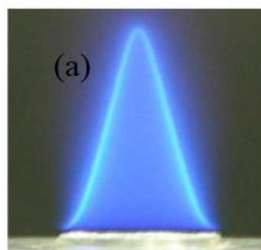
A research group led by Professor Hiroshi Sakurai of Gunma University and Associate Professor Nobuyuki Kawahara of Okayama University succeeded in developing a new method of measuring the temperature and chemical reaction of a combustion flame by precisely measuring the intensity of Compton-scattered X-rays from the combustion flame irradiated with high-brilliance and high-energy X-rays of the BL08W beamline at SPring-8.

The temperature distribution of a combustion flame was measured using X-rays and the results were compared with those obtained using conventional thermocouples. The results indicated that the temperature distribution was precisely measured. With the new method, there was no effect of thermal inflow from the thermocouple wire on the measurement results because it was a noncontact method, enabling more precise temperature measurement than that using thermocouples. In addition, the analysis of the spectra of Compton-scattered X-rays at each zone

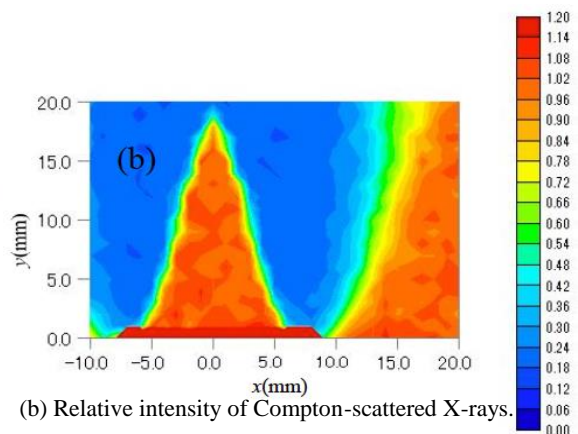
of the flame revealed that the combustion reaction significantly proceeded in the luminescent zone at the boundary of the flame, revealing that many OH radicals and hydrogen atoms exist in the high-temperature region outside the boundary.

This method can be used for noncontact measurement of the temperature distribution and chemical reaction of internal combustion engines, because high-energy X-rays with a high permeability are used in this analytical method. This measurement method is expected to help develop innovative engine technology with improved efficiency.

The details of this study are explained in *Journal of Synchrotron Radiation*, Vol. 23, pp. 617–621.



(a) Photograph of a flame.



(b) Relative intensity of Compton-scattered X-rays.