In Situ Fast UV Gas Absorption Measurements on a Large Scale Boiler

Fateev, Alexander; Clausen, Sønnik

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IN SITU FAST UV GAS ABSORPTION MEASUREMENTS ON A LARGE SCALE BOILER

A. Fateev *, S. Clausen
Risø DTU, Denmark
alexander.fateev@risoe.dk

In situ simultaneously fast measurements of gas temperature and gas composition are an important task for many industrially running processes. In many cases the measurements have to be done in very aggressive and unstable in time hot gas environment which is realized, for example, in boilers and engines. Experimentally measured values of temperature and gas composition in various places inside of the boilers are used for advanced combustion control, and for validation and improvement of CFD codes those now recognized as an obligatory tool in boiler design and optimization.

Optically-based technique is beneficial because it is non-intrusive, accurate, has low response time and can be performed *in situ* for various extremely hard conditions. Infrared (IR)-based *in situ* optical diagnostics of hot gases has been extensively developed for many years in our laboratory and it has been successfully used in practice on various industrial sites in Denmark and Europe. In very humid and hot environments ultraviolet (UV) technique is more sensitive for fast gas concentration measurements of NO and SO_2 and gives a great opportunity for measurements of O_2 concentration. Analysis of the fine structure of the UV absorption bands of, for example, NO, SO_2 or O_2 allows also to determine a value of the gas temperature.

In our work we report and discuss about fast *in situ* UV gas absorption and temperature measurements inside of a large scale industrial boiler. We have developed a special 9-m long water-cooled probe with a removable UV head, Figure, for the fast UV gas absorption measurements. The UV head is also suitable for the fast IR gas emission measurements. The UV gas absorption measurements were performed with a high-resolution UV spectrometer equipped with a CCD camera. A deuterium lamp was placed in the UV head and used as a light source. The UV light after passing of the gas slab was collimated into a 10 m long optical fiber coupled with the spectrometer. Measurements have been performed up to 8 m inside of the hot gas stream close to the super heater region at the Block 2 Avedøre multi-fuel power plant south of Copenhagen.