



Kent Academic Repository

Cugley, James, Lu, Gang, Yan, yong and Searle, Ivan (2018) *Flame monitoring and characterisation through digital imaging and spectrometry*. In: IMEKO 2018- The XXII World Congress of the International Measurement Confederation. . Institute of Measurement and Control

Downloaded from

<https://kar.kent.ac.uk/69038/> The University of Kent's Academic Repository KAR

The version of record is available from

This document version

Updated Version

DOI for this version

Licence for this version

UNSPECIFIED

Additional information

Versions of research works

Versions of Record

If this version is the version of record, it is the same as the published version available on the publisher's web site. Cite as the published version.

Author Accepted Manuscripts

If this document is identified as the Author Accepted Manuscript it is the version after peer review but before type setting, copy editing or publisher branding. Cite as Surname, Initial. (Year) 'Title of article'. To be published in *Title of Journal*, Volume and issue numbers [peer-reviewed accepted version]. Available at: DOI or URL (Accessed: date).

Enquiries

If you have questions about this document contact ResearchSupport@kent.ac.uk. Please include the URL of the record in KAR. If you believe that your, or a third party's rights have been compromised through this document please see our [Take Down policy](https://www.kent.ac.uk/guides/kar-the-kent-academic-repository#policies) (available from <https://www.kent.ac.uk/guides/kar-the-kent-academic-repository#policies>).

Oral session preferred

Flame monitoring and characterisation through digital imaging and spectrometry

James Cugley¹, Gang Lu¹, Yong Yan¹, Ivan Searle²

jc887@kent.ac.uk

¹School of Engineering and Digital Arts, University of Kent, Canterbury, Kent CT2 7NT, UK

² British Sugar PLC, Wissington Sugar Factory, College Rd,

Wissington, King's Lynn PE33 9QG, UK

Fossil fuel fired boilers are often required to work under variable operation conditions. The variability in fuel diet and load conditions result in various problems in boiler performances. A methodology based on digital imaging and spectrometric techniques is proposed for flame monitoring and characterisation on utility boilers. The system developed consists of an optical probe/water jacket, a digital camera, a spectrometer covering a spectral range from 200nm to 900nm and an embedded computer with associated application software. Computer algorithms are established to determine flame characteristic parameters, including size, shape, temperature and spectral distributions. The spontaneous emissions of flame radicals (e.g., CH* and C₂*) and alkali elements such as Sodium (Na) and Potassium (K) are characterised and their relationships with the combustion inputs (e.g., fuel, air-to-fuel ratio) and pollutant emissions (e.g., NO_x) are studied. The methodology proposed are examined on a gas-fired heat recovery boiler under different operation conditions. The results obtained suggest there exist close correlations between flame parameters computed and boiler operation conditions. In particular, flame radicals (CH* and C₂*) and their ratio show a close relationship with the air-to-fuel ratio. The spectral intensities of Na (589nm) and K (767nm) also illustrate a strong link to the type of fuel. Current work focuses on quantifying the relationship between the flame parameters and the boiler operation conditions and establishing a computational model for online prediction of emissions from flame characteristic parameters.