Investigations into the Impact of Coal Moisture on Burner Performance through Flame Imaging and Spectroscopic Analysis

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Despite increasing use of renewable energy worldwide, coal remains to be the primary energy resource to meet the increasing demand for electric power in many countries. However, coal-fired power plants have to cope with coals with different properties, including those with high moisture content. It is known that moisture content in coal does not only affect coal handling but also burner performance, and thus combustion efficiency and emission formation process. A study is recently carried out to investigate the impact of moisture content in coal on the burner performance through flame imaging and spectroscopic analysis. Experimental tests were conducted on a 40MW_{th} coal-fired combustion test facility (CTF). A typical pulverised coal was fired in the study. The variation in evaporated coal moisture was replicated by injecting steam into the primary coal flow in the range of 7%-55% (PFM, primary flow moisture) under different operation conditions including variations in furnace load and fuel-to-air ratio. A flame imaging system and a miniature spectrometer were employed to acquire concurrently flame images and spetroscopic data (Fig. 1). The characteristic parameters of the flame such as spreading angle, temperature, oscillation frequency and spectral intensity are computed and their relationship with the operation conditions including PFM and emissions (NO_x, CO) are quantified. Fig. 2 illustrates typical flame images under different steam injections. Detailed experimental results and analysis will be presented at the conference.

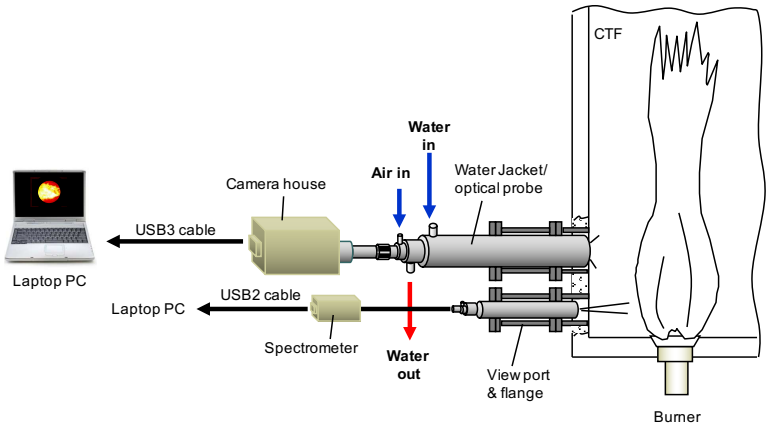

Fig. 1 Layout of flame monitoring systems

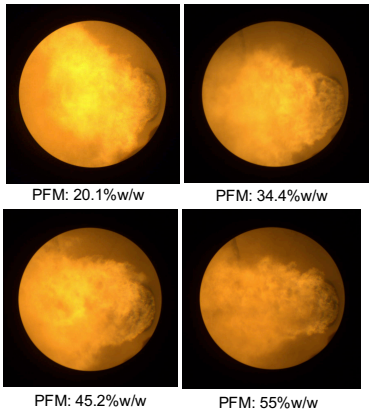

Fig. 2 Flame images

Keywords: CTF, high moisture coal, flame, digital imaging, image processing, spectroscopic analysis.

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