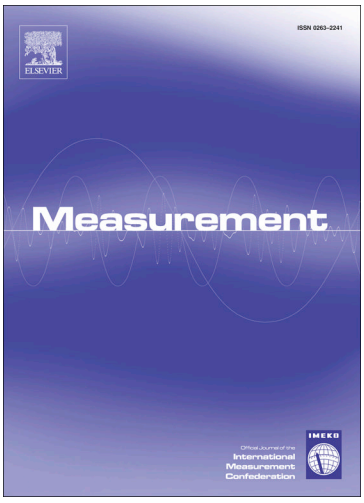

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Study of an improved two-colour method integrated with the emissivity ratio model and its application to air- and oxy-fuel flames in industrial furnaces

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Abstract

Inspired by the multi-wavelength method, the present work innovatively introduces an easier-to-describe emissivity ratio model to replace the customary grey body assumption, thus polishing the algorithm of the traditional two-colour method. The precision of this method was verified with a blackbody furnace, for which the relative errors were within ± 1.50 %. In situ experiments show that the air-coal flame in a stokerfeed boiler is significantly close to a grey body over the detected wavelength range of 600-1000 nm, except for the emission/absorption lines, and a nearly negligible disparity (25.58 K) is found between the temperature outcome of the improved method and that of the traditional method. The oxy-coke flame in a pilot-scale test facility, however, differs from a grey body to a certain degree within that range, resulting in the deviation of the temperature obtained by the traditional method from that obtained by the improved method by more than 190 K. Obviously, the traditional method is no longer valid in this case. Thus, the two-colour method is sensitive to emissivity variations of the target, and the grey body assumption incurs distinct restrictions on application of the traditional method, thereby highlighting the advantages of the improved method.

***Keywords*:** emissivity ratio model, grey body assumption, two-colour method, multi-wavelength method, flame temperature