

# **Design and Optimization of a Two-Color Pyrometer**

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Flame diagnostics is an important topic in the field of combustion research. Flame temperature and soot volume fraction are two particular quantities of interest to combustion researchers. One common technique employed to make these measurements in the hostile environment of a flame is two-color pyrometry. Two-color pyrometry is a technique which relies on measuring the intensity of emitted radiation from soot in a flame at two separate wavelengths. Equations can be derived such that by making intensity measurements at two separate wavelengths, both flame temperature and soot volume fraction can be determined.

The goal of this study was to yield an understanding of two-color pyrometry and attempt to validate the technique. Validation was performed by comparing soot volume fraction measurements made by two-color pyrometry with soot volume fraction measurements made by laser extinction. Flame temperature measurements were compared with other published data.

The validation showed that the soot volume fraction measurements made by two-color pyrometry were accurate when compared to those made by laser extinction. Though the measurements made in this study were in agreement, the values measured here were higher than those found in other published data by a factor of two. Flame temperature measurements were observed to follow the same trend as published data for identical flame conditions, though the actual values of flame temperature measured in this study were about 100K lower. The higher soot volume fraction found in this study is consistent with the lower measured flame temperature. The results of this study suggest that two-color pyrometry provides a fairly accurate, simple technique for the measurement of flame temperature and soot volume fraction.