

用激光诱导可见光法测量电场影响下火焰碳烟颗粒浓度的分布变化

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摘要

建立了一套基于激光诱导白炽光法(LII-Laser Induced Incandescence)及双色法定量的颗粒浓度定量诊断系统。该系统利用高能脉冲激光瞬间加热火焰中的纳米颗粒,使颗粒迅速升温到3500至4000K,从而诱发白炽光,再利用双色法进行标定,确定光强与颗粒浓度的量化关系,从而计算出火焰中颗粒的绝对浓度以及二维分布。利用该系统测量电场影响下的火焰碳烟颗粒浓度变化发现:正负外加电场均可以降低火焰中碳烟颗粒的浓度,但在加压初期浓度均有升高,并且高度在7 kV时开始降低,浓度在小幅度升高后持续下降,离子风加强了物质间的混合,燃烧充分。热泳力瞬时采样法佐证了负电场对火焰碳烟颗粒有更强的抑制作用,当电压为-15kV时,浓度降低至小于10%。

关键词 [激光诱导白炽光](#) [纳米颗粒](#) [碳烟](#) [浓度测量](#) [火焰](#)

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Electric Field Control of Soot Distribution in Flames Using Laser-Induced Incandescence

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Abstract

A 2-color laser-induced incandescence (2-color LII) diagnostics system was set up. Based on this method, an optical experimental facility was set up to investigate the effect of electric fields on soot particle concentration in air co-flow ethylene diffusion flames. The results gave an absolute volume concentration of soot particles in flames. With the presence of electric field, whatever it was negative or positive, soot concentration and distribution can be changed, soot concentration first increased and then decreased at a certain condition with an increase electric field intensity. Ionic wind would take an important role to change the flame shape and soot particles volume concentration after 7 kV. TSPD (Thermophoretic Sampling Particles Diagnostics) results showed negative electric field was stronger than positive electric field in decreasing the soot volume concentration. Electric field could suppress the soot particles growth and aggregation.

Key words [laser-induced incandescence](#) [nano-particle](#) [soot](#) [concentration](#) [flame](#)

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