Soot optical band gap evaluated through in-situ and ex-situ measurements as tracer of soot evolution in premixed flames

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The optical band gap has been used considerably in evaluating carbon network structures in terms of sp^2/sp^3 sites and size of aromatic clusters. However, optical band gap determination of soot particles from optical measurements is complex due to the effects of other species including organic compounds, and the contribution of absorption from organics to the total soot absorption in the UV/visible range is often overlooked. In the present work we propose a new method for separating the optical band gap of organic compounds (E1) from that of soot (E2). We apply the method to both extinction (in situ) and absorption (ex situ) measurements at various heights in premixed laminar flat flames, and find good agreement between the methods. The band gap of soot (E1) decreases as soot ages and reaches very low values typical of large size graphitic islands, while the band gap of organics (E2) is relatively constant indicating that the organic carbon compositions in unchanged. The possibility to evaluate chemical and structural properties of the soot from the band gap information is discussed.