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Soot formation in unstrained diffusion flames ETIENNE ROBERT, Department of Mechanics, Kungliga Tekniska Högskolan (KTH), Stockholm, Sweden, NILS-ERIK OLOFSSON, JONATHAN JOHNSSON, HENRIK BLADH, PER-ERIK BENGTSSON, Combustion Physics, Lund University, Lund, Sweden — The formation of soot particles has been investigated in CH_4/O_2 diffusion flames using a burner which allows the creation of a nearly unstrained planar reaction sheet. The sooting limits, soot volume fraction and particle size were measured as a function of bulk flow across the flame mixture strength and transport properties of the reactants. Mass spectrometry was used to measure the effective mixture composition close to the flame and Laser Induced Incandescence (LII)for the soot volume fraction and particle size. The parameter space was mapped as follows: Starting from a stable non-sooting baseline flame, the mixture strength was progressively increased by raising the fuel volume fraction while keeping other parameters constant (bulk flow across the flame, oxidant and inert composition). As the mixture strength was increased, the soot volume fraction and particle size increased up to a point where very big soot particle aggregates became visible to the naked eye on the flame side of the sooting layer. The exact mechanism by which these super aggregates arise is unknown but it is postulated that the absence of strain in the flow field and the thermophoretic effect allows soot particles to remain in a region of the burning chamber suitable for growth for an extended period of time.

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