au programme des séminaires ICARE…

Correlations of High-Pressure Lean Methane and Syngas Turbulent Burning Velocities: Effects of Turbulent Reynolds, Damköhler, and Karlovitz Numbers

par

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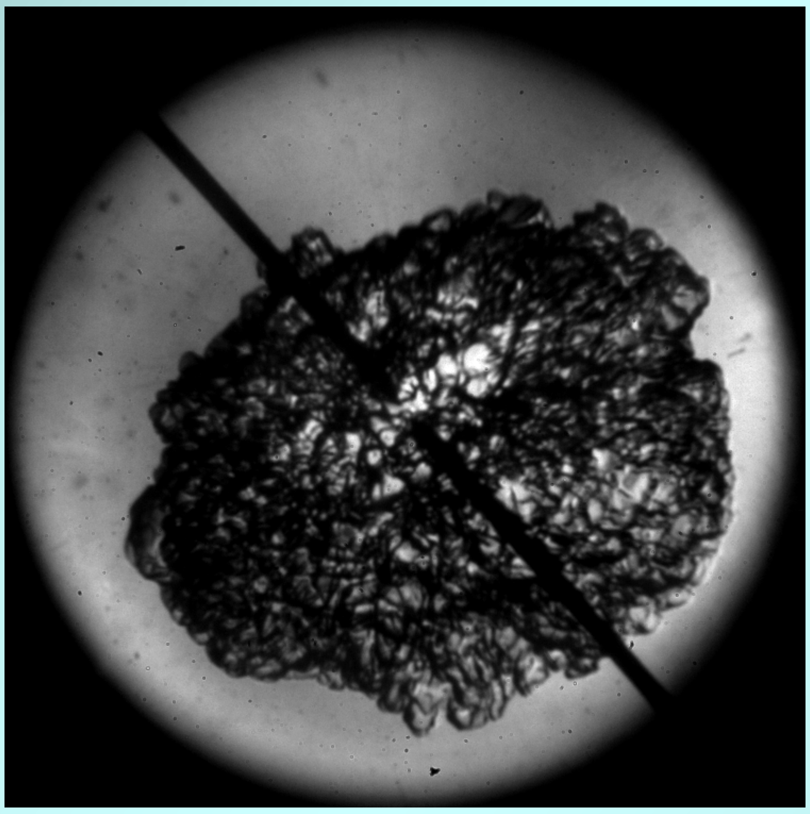
le jeudi 26 juin 2014 à 11h

salle de réunion ICARE



This seminar talks correlations of high-pressure turbulent burning velocities (S_T) using our recent S_T measurements of lean methane and syngas spherical flames at constant elevated pressures (p) and constant turbulent Reynolds numbers ($Re_T \equiv u'L_I/\nu$), where u', L_I, and n are the r.m.s. turbulent fluctuation velocity, the integral length scale of turbulence, and the kinematic viscosity of reactants, respectively. Such constant constraints are achieved by applying a very large high-pressure, dual-chamber explosion facility that is capable of controlling the product of $u'L_I$ in proportion to the decreasing n due to the increase of p. We found that, contrary to popular scenario for S_T enhancement with increasing p at any fixed u', S_T actually decreases similarly as laminar burning velocities (S_L) with increasing p in minus exponential manners when values of Re_T are kept constant.

Moreover, S_T increases noticeably with increasing Re_T varying from 6,700 to 14,200 at any constant p ranging from 0.1 MPa to 1.0 MPa. It is found that a better general correlation for the normalization of S_T is a power-law relation of $S_T/u' = \mathrm{a}Da^{\mathrm{b}}$, where $Da = (L_I/u')(S_L/\delta_F)$ is the turbulent Damköhler number, $\delta_F \approx \alpha/S_L$ is the laminar flame thickness, and α is the thermal diffusivity of unburned mixture. Thus, the very scattering S_T data for each of lean methane and syngas mixtures can be merged on their S_T/u' *vs.* Da curves with very small data fluctuations. For lean methane flames with the Lewis number (Le) ≈ 1, $S_T/u' \approx 0.12Da^{0.5}$ supporting a distributed reacton zone model anticipated by Ronney (1995), while for lean syngas flames with $Le \approx 0.76 << 1$, $S_T/u' \approx 0.52Da^{0.25}$ supporting a theory predicted by Zimont (1979). A simple physical mechanism is proposed to explain what causes the aforesaid discrepancy on the power-law constants.

Prochain séminaire prévu 17/07/2014, 11h : *Experimental and kinetic modelling of trans-2-butene oxidation in jet-stirred reactor and combustion bomb*, par Yann FENARD, doctorant à ICARE

Pour tout renseignement complémentaire, ou proposition de séminaire par un thésard ou un chercheur invité, contacter Ivan Fedioun, fedioun@cnrs-orleans.fr, poste 5520, 06.62.81.23.08