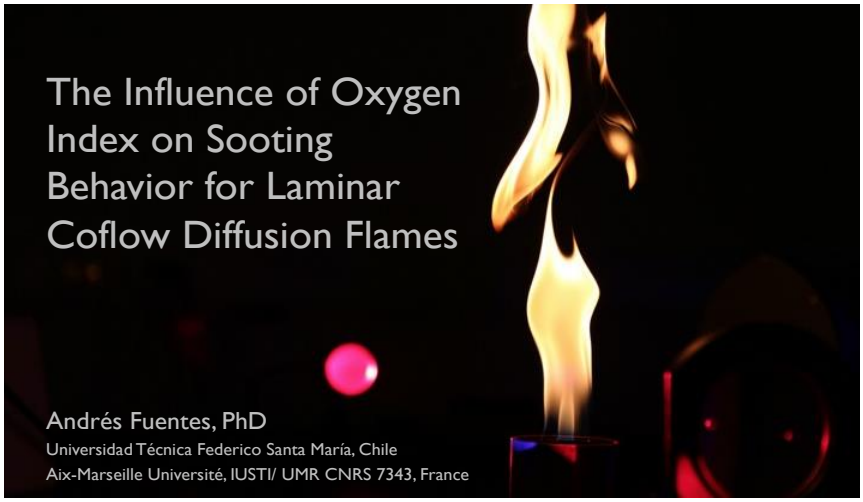

Abstract

Energy consumption continues to increase steadily due to increasing world population and economic development. The main source of energy worldwide is the combustion of fossil fuels. However, the combustion of hydrocarbons produces several gaseous and particulate emissions such as CO_2, CO, NOx and soot, which are harmful to the environment and human health. Substantial efforts are underway to enhance the efficiency of combustion devices by increasing the radiative heat transfer while reducing the emission of soot and greenhouse gasses to the atmosphere.

Most combustion processes use air as the oxidizer. One efficient way of affecting the flame radiative properties, combustion efficiency and pollutant emissions is to change the oxygen concentration in the oxidizer flow, named the oxygen index (OI). Combustion devices employing a high OI instead of air have been used in the industry, such as oxy-fuel and oxygen-enriched combustion, where the addition of oxygen is also proposed as a mean to suppress the release of soot through the enhanced soot oxidation.

In many industrial combustors, this technology increases the flame temperature and thus radiative heat transfer and reduces fuel consumption and exhaust gasses. However, studies using industrial combustion devices are challenging due to the transient nature of the process, the inhomogeneity and turbulence of the flows. For this reason, laminar diffusion flames are used to simplify the analysis and experimental measurements and to gain fundamental insights into the effects of a certain parameter.

The OI has important influences on laminar diffusion flame characteristics, such as the flame shape, radiative loss, and soot formation and oxidation processes. Recent studies in our group analyzed the effects of OI between 21% and 37% on flame structure, soot production and flame radiation in ethylene, butane and propane flames.

The aims of the seminar is to present the relationship between soot volume fraction, temperature, flame height and radiant fraction for ethylene, propane and butane diffusion flames by means of non-intrusive measurements in axisymmetric laminar flames under different OI. Since these three fuels have different sooting propensities a scaling analysis for buoyancy-controlled axisymmetric flames, based on Smoke Pint Height will be also presented and discussed during the seminar.

Proffesor Andrés Fuentes

Short Biography

From 2014 Dr. Andrés Fuentes is Associate Professor at Departamento de Industrias, Universidad Técnica Federico Santa María, Chile. The research activities are carried out in the EC2G Group from 2010. Originally from Santiago, Chile, he graduated with an Industrial Engineering from the University Técnica Federico Santa María, Chile. He earned his Msc and PhD in Fluid Mechanics, Energy and Combustion at University of Poitiers, France.

He also worked (2007) as a Research Fellow at the BRE Centre for Fire Safety Engineering at the University of Edinburgh. Also was Maître des Conférences at Ecole Polytechnique Universitaire de Marseille, Université de Provence (Aix-Marseille 1), France. In this institution the research activities were carried out in the Fire Dynamics Group at IUSTI, from 2007.

Research Interests

The research interests include, energy conversion, heat and mass transfer processes in combustion, ignition and flame propagation, microgravity combustion, smouldering combustion and thermal solar energy.