AN EXTENDED ANALYSIS FOR THE DYNAMIC OF SOOT PARTICLE IN DROPLET COMBUSTION

Eduardo Plasti Melara [1] (UNESP/Guará, Bolsista PIBIC/CNPq)
Fernando Fachini Filho [2] (CTE/LCP, Orientador)

ABSTRACT

This work addresses some particular aspects of the dynamic of soot particles. The analysis will be developed numerically. The dimensions of soot particles are about nanometer. In this characteristic spatial scale, the main two forces acting on the particle are drag and thermophoretic (proportional to the temperature gradient). The first one pushes soot to the flame, however the second one pulls soot away from the flame. Therefore, for conditions in which the drag force prevails the particulate emission to the ambient atmosphere is reduced, because the soot is burnt at the flame. Moreover, a reduction on soot formation can inhibit fire propagation, mainly in the microgravity condition because the heat transfer by radiation from the soot particles is an important process in the flame propagation. For conditions in which the thermophoretic force prevails lead to the sooty combustion regime because the particles do not pass through the flame. The description of the dynamic of such particles will reveal features which will be used in the control of the soot production. The model, an extension of a previous one, includes the modification on the ambient temperature gradient due to the soot displacement. The correction on the temperature gradient leads to an extra term in the thermophoretic force expression. The results of the present model do not reproduce the stable equilibrium of the soot, but are able to point out the necessary of a third force to stable the particle.

[1] Aluno do curso de Engenharia Elétrica – **E-mail: edumelara@gmail.com**
[2] Pesquisador do Laboratório Associado de Combustão e Propulsão – **E-mail: fachini@lcp.inpe.br**