Universidad Carlos III de Madrid

Seminario del Instituto Gregorio Millán

Homogeneous vapor condensation in boundary layer flows

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(Modelling and Numerical Simulation / uc3m)

Abstract

Condensation of vapors containing combustion products occurs very often in combustion chambers. These products are typically highly agressive, so subsequent deposition of droplets containing them on chamber walls may result in serious damages. There are other examples where condensation and deposition on a surface is desirable, as in the case of technological processes that produce materials from vaporized substances.

Any case, calculation of deposition rates is very important for regulating its effects, beneficial or not, in many situations in industry.

Condensation of vapor molecules may occur on particles already present inside the chamber or, on the contrary, on clusters produced simultaneously by nucleation of the same molecules. In the first case we talk about heterogeneous condensation and in the last one about homogeneous condensation. Heterogenous condensation in boundary layer flows has been treated extensively on literature, but much less in known in the case of homogeneous condensation.

We propose a thermophysical model for describing homogeneous condensation in laminar boundary layer flows focusing on a stagnation-point flow. The numerical solution of the model provides the spatial profiles of vapor density, droplet density and number of condensate molecules per droplet. In addition we have obtained approximate solutions by using Perturbation Theory techniques which shed new light on the numerical results.

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