

## **Bayesian inference on uncertain kinetic parameters for the pyrolysis of composite ablators**

The heat shield of high speed reentry spacecraft is often made up of porous ablative thermal protection materials (TPMs) that can accommodate high heating rates and heat loads through phase change and mass loss. When the temperature increases, those materials absorb heat and start to pyrolyze, releasing gases that interact with the surrounding flow. Modeling the species production and the material decomposition rate is important for their use in numerical simulations for the robust determination of heat shield thickness. To this end, pyrolysis experiments have been performed on TPMs in order to determine the kinetic parameters of chemical laws that govern mass loss and species production rates [Wong et al., *Polym. Degrad. Stabil.*, 112:122–131, 2015]. Samples are heated in a furnace and the mass loss is measured while the species produced are collected.

In this talk, we introduce the context of physico-chemical modeling of ablation, the experiments, and the sources of uncertainty. We present the model used to link the kinetic parameters to the experimental observations by means of Arrhenius laws. We then state the formulation of the inverse problem in a Bayesian framework and we discuss the elaboration of an appropriate likelihood function. We finally present results of the inversion procedure, with particular attention to the influence of the number of species taken into account in the model.

**Keywords** : Inverse problem, Chemistry, Chemical Kinetics and Combustion; Pyrolysis