Etude expérimentale de l'injection de fluides à haute pression (supercritique) pour une application de type moteurs-fusées

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Abstract
A growing number of applications require the injection of liquids above their critical point. However, the physics of such flows is poorly understood, in particular the mechanisms governing the transition from subcritical two-phase injection to single-phase supercritical mixing. The aim of this work is to contribute to the better understanding of these phenomena, by collecting and analyzing qualitative and quantitative experimental data on a multi-species injection (ethane-nitrogen) under transcritical and supercritical conditions. To achieve this, four optical diagnostics are implemented -- shadowgraphy, DBI, Image Correlation Velocimetry and spontaneous Raman spectroscopy -- on two test benches and two injector designs, including a coaxial rocket engine injector. This provides a wide range of information on the jet and its disintegration. In particular, two new injection regimes are formally identified and defined, a complete velocity field database is compiled, and previously unavailable insights are obtained on the Raman spectrum of ethane around its critical point