Velocity field measurements in gas phase internal flows by molecular tagging velocimetry

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Abstract

The goal of the present work is to implement Molecular Tagging Velocimetry (MTV) for the analysis of internal gas flows in mini-channels. A MTV experimental setup has been designed. Tagging and detecting steps are respectively insured by a UV laser and a CCD camera coupled to intensified relay optics. A specific channel with 1×5 mm^2 rectangular cross section has been designed and equipped with integrated temperature sensors along its 20 cm length. It has been manufactured in PEEK (PolyEtherEther-Ketone) and Suprasil® optical windows have been integrated for the tagging access. Image processing allows extraction of velocity profiles for a pressure driven steady flow of argon through this channel. These profiles are compared to the theoretical profiles of laminar flows and the accuracy of the method is discussed. The MTV potential for the analysis of internal gaseous flows is commented on, with a discussion on perspectives for velocity measurement in rarefied flows and direct access to slip velocity at the walls.