Transport phenomena in passively manipulated chaotic flows: split-and-recombine reactors

Submitted by Thierry Lemenand on Fri, 03/20/2015 - 15:49

Titre: Transport phenomena in passively manipulated chaotic flows: split-and-recombine reactors

Type de publication: Communication

Type: Communication avec actes dans un congrès

Année: 2013

Langue: Anglais

Date du colloque: 7-11/07/2013

Titre du colloque: ASME-FEDSM 2013: 6th Symposium on Transport Phenomena in Mixing

Pagination: 10

Auteur: Ghanem, Akram [1], Lemenand, Thierry [2], Della Valle, Dominique [3], Peerhossaini, Hassan [4]

Pays: Etats-Unis

Editeur: ASME (American Society of Mechanical Engineers)

Ville: Nevada

Mots-clés: chaotic advection [5], Industrial processes [6], Iodide-iodate chemical probe [7], Mass transfer [8], mixing [9], Split-and-recombine reactor [10]

Résumé en anglais: Static mixers and multifunctional heat exchangers/reactors are being used increasingly in process industries. In the inertial or turbulent regime, mixers often incorporate inserts or corrugated walls whose primary function is to create embedded flow vorticity. On the other hand, in low- Reynolds-number flows, for viscosity or residence time purposes, it is necessary to provide solutions based on kinematic mixing, i.e. the topology of the primary flow, such as split-and-recombine reactors (SAR). The concept is based on passive liquid stream division, then rotation in bends of opposite chiralities, and finally recombination, achieving stretching/folding following the baker’s transform. Mixing is efficiently ensured by diffusion without generating prohibitive pressure drops. In this work, a chemical probe is used to study mixing and mass transfer in two different split-and-recombine square duct geometries, SAR-1 and SAR-2 of 3 mm side. Results show that effective mass transfer and mixing can be achieved with a short reactor length and moderate pressure losses; the SAR-1 geometry being more efficient. The chaotic configurations are a good compromise even for higher Reynolds numbers compared to static mixers operating in the transitional regime: they produce moderate pressure losses while enhancing mass transfer.


Liens

Publié sur Okina (http://okina.univ-angers.fr)