

"Alkiviades Ch. Payatakes" Distinguished Lecture 2019

NETmix: Beyond Network Models

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Abstract

Mixing is at the core of many industrial processes that require the contact of reactants for chemical reactions or the homogenization of solutions or emulsions. Static mixers have been used in industrial applications to perform continuous operations and have become standard equipment since the 1970s, as an alternative to mechanical mixers.

NETmix is a mixer and chemical reactor that consists on a 2D percolation network of mixing chambers interconnected by transport channels, creating a series of zones of strong mixing (the chambers) and of mostly segregation (the channels). The network is generated by the repetition of unit cells composed of one chamber and two inlet and two outlet channels oriented at a given angle from the main flow direction. When fluids flow through this network, at a critical channel Reynolds number, the hydrodynamics evolves to a self-sustained oscillatory laminar flow regime inside the chambers inducing local strong laminar mixing.

In this presentation we show how NETmix was conceived as a network model to study macro and mixing, and evolved to an actual static mixer that has been successfully tested for many applications (e.g. fast precipitation/crystallization homogeneous reactions; liquid-liquid reactions; photocatalytic reactions; and gas-liquid for the continuous production of CO₂ hydrates).