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Luca Sicignano, Giovanna Tomaiuolo, Antonio Perazzo, Steven P. Nolan, Pier Luca Maffettone, Stefano Guido

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The effect of shear flow on microreactor clogging

Luca Sicignano[a], Giovanna Tomaiuolo[a]*, Antonio Perazzo[a‡], Steven P. Nolan[b], Pier Luca Maffettone[a] and Stefano Guido[a]

[a]*Dipartimento di Ingegneria Chimica, dei Materiali e della Produzione Industriale, Università di Napoli Federico II, P.le V. Tecchio 80, 80125 Napoli, Italy.*

[b]*Universiteit Gent, Department of Chemistry, Krijgslaan 281, S-3, 9000 Ghent, Belgium.*

‡ *Current affiliation: Department of Mechanical and Aerospace Engineering, Princeton University, 1 Olden Street, Princeton, 08544, New Jersey, USA.*

*g.tomaiuolo@unina.it

Abstract

Solid handling is a key issue in microreactors where clogging problems can be severe due to confined flow conditions. Here, microreactor clogging is investigated in a Buchwald–Hartwig C–N cross-coupling reaction of amines with organohalides important in the pharmaceutical and fine chemicals industries for the production of aromatic amines. The reaction takes place in a tubular stainless steel continuous-flow reactor and generates solid particles by precipitation of potassium bromide in the continuous phase. The reactor output is fed to a glass microchannel where the flowing particles are imaged by on-line high-speed video microscopy. It is found that KBr particles adhere to the channel wall and aggregate into clusters, eventually leading to channel clogging. The effect of flow is studied by setting the Reynold number (Re) at 1.5 and 15. At Re =1.5 cluster growth is faster and less dense, dendritic structures made of needle-like crystals are observed. At Re =15, cluster growth is slower and more compact structures of spherical shape are found. Clogging time is faster at Re =15. These results can be explained by the interplay between flow-induced