Research topics

Reactive Distillation

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Abstract

Reactive distillation not only removes a step in a flowsheet by carrying out two operations in one unit, but also allows reactions with unfavourable equilibria to achieve higher reactor conversions and to improve reaction selectivity. This project aims to identify the optimal structural configuration and operating conditions for reactive distillation.

Project description

If reasonable reaction rates can be achieved at the relatively low temperatures and pressures normally encountered in distillation, then reactive distillation can sometimes have significant advantages over separate reaction and distillation steps. Reactive distillation can overcome unfavourable equilibria, allow unwanted side reactions to be avoided or remove the need for azeotropic distillation.

The flowsheet synthesis and column design issues in reactive distillation are significantly more complex than for conventional distillation. Both homogeneous and heterogeneous catalysts can be used. In some applications the whole of the column is reactive. In others only part of the column is reactive with conventional separation occurring in the non-reactive zones. Many column design options are possible, with different feed and product take-off arrangements, with intermediate heating and cooling and with different recycle options.

Flowsheet options include pre-reactors, non-integrated separation units, such as conventional distillation columns, membranes and stripping columns, and complex column configurations. Novel processes, with intensified integration of the reaction and separation steps and enhanced performance, such as a reactive dividing wall column, will be generated and evaluated.

This work develops conceptual design methods for reactive distillation columns and flowsheets that allow structural options and operating conditions to be selected in a systematic way. The results will allow design alternatives to be generated, evaluated and screened.