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DIFFUSION EFFECTS ON MULTICOMPONENT CONDENSATION
-influence of glide on mass transfer resistance

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ABSTRACT

With the use of zeotropic mixtures in heat pumps, there is often a decrease of condenser performance. In some cases, e.g. shell side condensation with low driving forces, the decrease can be up to as much as 70%. One reason for this decrease in performance can be mass transfer resistance both in the gas and the liquid phase. If there is a significant mass transfer resistance, there is a depletion of the heavier components in the gas phase at the interface, and enrichment of the heavier component in the liquid phase. Diffusion is likely to stand for the mass transport in these regions.

In this work detailed calculations have been carried out for condensation of zeotropic mixtures on a column of horizontal smooth tubes. This in done to investigate how the mass transfer resistances in both phases are influenced by different mixtures´ temperature glide, and how this in its turn influences the condensation rate. In the calculations, Fick´s transport equation is solved in the liquid together with the velocity profile, and in the gas phase Maxwell-Stefan's transport equations are solved. A high level of detail is accomplished by numerical integration over each tube, instead of calculating tube averages.

Results show that glide and duty greatly influence the effect of mass transfer resistance. High glide for a mixture and high duty are unfavorable regarding mass transfer resistance, especially in the liquid phase. The question at what glide there will be a significant effect of mass transfer resistance is discussed.