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Evaporative and Convective Instabilities for the Evaporation of a Binary Mixture in a Bilayer System WEIDONG GUO, RANGA NARAYANAN, Department of Chemical Engineering, University of Florida, Gainsville — Evaporative convection in binary mixtures arises in a variety of industrial processes, such as drying of paint and coating technology. There have been theories devoted to this problem either by assuming a passive vapor layer or by isolating the vapor fluid dynamics. Previous work on evaporative and convective instabilities in a single component bilayer system suggests that active vapor layers play a major role in determining the instability of the interface. We have investigated the evaporation convection in binary mixtures taking into account the fluid dynamics of both phases. The liquid mixture and its vapor are assumed to be confined between two horizontal plates with a base state of zero evaporation but with linear vertical temperature profile. When the vertical temperature gradient reaches a critical value, the evaporative instability, Rayleigh and Marangoni convection set in. The effects of vapor and liquid depth, various wave numbers and initial composition of the mixture on the evaporative and convective instability are determined. The physics of the instability are explained and detailed comparison is made between the Rayleigh, Marangoni and evaporative convection in pure component and those in binary mixtures.

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