

Abstract Submitted
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Instability of displacement of Oldroyd-B fluid by air in a Hele-Shaw cell¹ PRABIR DARIPA, Texas A&M University — We study the displacement of an Oldroyd-B fluid in a Hele-Shaw cell when driven by air. In particular, we explicitly obtain an analytical expression for the growth rate of instability which depends on the relaxation and retardation (time) constants, denoted by λ , and λ_1 respectively, appearing in the Oldroyd-B constitutive relations. When these two constants are zero, we recover the classical Saffman-Taylor result for a Newtonian liquid displaced by air. Our results show that this displacement process is more unstable than the case when a Newtonian fluid is displaced by air. The analytical results are plotted and compared with numerical results on this unstable displacement process available in the literature. The agreement is found to be excellent. In particular, results show that the non-Newtonian case (i.e., Oldroyd-B) is more unstable than the Newtonian case.

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