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Rayleigh-Taylor convection of immiscible fluids in three-dimensional porous media VLAD GIURGIU, MARCO DE PAOLI, FRANCESCO ZONTA, ALFREDO SOLDATI, Vienna Univ of Technology — The Rayleigh-Taylor instability of two immiscible fluids is studied by means of a Phase-Field Method (PFM). With this description, the fluid-fluid interface is modeled as a thin transition layer where all the thermophysical properties vary rapidly but without discontinuities. This is achieved by introducing a phase indicator that is uniform in the bulk phases and varies across the thin separation interface between the two phases. This provides the accurate description of the interfacial dynamics, which is required to improve the current physical modeling of the transfer mechanisms between the two fluids in the present situation (not yet available). The fluid velocity is determined by the Darcy law, where the surface tension effects are also accounted for, whereas the concentration field is determined by the Cahn-Hilliard equation. Current results obtained in the 3D configuration are also compared with results obtained in the 2D case to highlight the possible modifications of the flow topology coming from the coupled interaction between surface tension and gravity effects in a 3D environment.

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