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Numerical simulation of droplet formation by Rayleigh-Taylor instability in multiphase corium RAPHAEL ZANELLA, HERVE HENRY, Laboratoire de Physique de la Matiere Condensee, Ecole Polytechnique, CNRS, IP Paris, Palaiseau, France, ROMAIN LE TELLIER, CEA, DEN, DTN/SMTA/LMAG, Cadarache, Saint Paul-lez-Durance, France, MATHIS PLAPP, Laboratoire de Physique de la Matiere Condensee, Ecole Polytechnique, CNRS, IP Paris, Palaiseau, France — During a severe accident in a nuclear reactor, the melting of the core forms a multiphase pool (corium), where the heat transfer at the boundary is affected by the segregation of the metallic and oxidic liquid phases driven by chemical and convective mass fluxes [1]. We use a Cahn-Hilliard pseudo-binary model to describe the uranium/zirconium/oxygen/iron mixture. The diffusion and the convection are governed by the Cahn-Hilliard equation and the Navier-Stokes equations with the buoyancy and capillary forces. Also used for hydrodynamic coarsening [2], the model is solved in 2D and 3D with a spectral code. The initial configuration of a lighter layer of iron-rich fluid above a heavier layer of uranium/zirconium/oxygen mixture is mechanically stable. However, as diffusion progresses, the heavier metallic phase form at the interface. Due to the Rayleigh-Taylor instability, droplets of metallic phase grow and fall into the underneath layer with a fixed frequency. The droplet formation observed in a former experiment of corium stratification transient [3] is well captured. [1] C. Cardon, R. Le Tellier, M. Plapp. CALPHAD 52, 2016. [2] H. Henry, G. Tegze. Phys. Rev. Fluids 3, 2018. [3] Kurchatov Institute. RCW Post-Test Analysis Results (OECD report), 2003

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