EFFECT OF VISCOSITY AND SURFACE TENSION ON THE GROWTH OF MAGNETO RAYLEIGH-TAYLOR INSTABILITY INDUCED BY LASER AT TWO FLUID INTERFACE

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Two fluid interface may be unstable under a constant force or gravity or impingement of a shock at the interface. Nonlinear structures like bubble will be formed by lighter fluid inside heavier fluid where as spike will be made of heavier fluid inside the lighter fluid under different conditions. Motion of these structures can be controlled by certain physical conditions in laser matter interaction like Inertial Confinement Fusion (ICF). In this paper we derived a set of nonlinear equation using potential flow model to explain the motion of the nonlinear interfacial structures (bubble/spike) induced by high power laser in presence of transverse magnetic field on two viscous fluids. Here, the wave vector is assumed to lie in interface and perpendicular to the magnetic field and shock impingement direction. There will be no effect of magnetic field as mentioned by Chandrasekhar[1] in classical theory. However, in nonlinear case, Rayleigh-Taylor instability can stabilize/destabilize or can show nonlinear oscillation in presence of magnetic field depending on the action of hydrodynamic and magnetic pressure [2]. Magnetic field and viscosity both have a stabilizing effect on growth rate of Rayleigh-Taylor instability (RTI). However, viscosity has damping oscillation effect and damping factor increases with increasing of kinematic viscosity of heavier fluid through which bubble rises. The oscillation of the interface can be controlled by viscosity of fluids and magnetic pressure either of conducting medium. Frequency of damped oscillation increases with increasing of Alfven velocity in both fluids. The bubble growth will be saturated if we increase the viscosity of the fluids keeping unchanged Alfven velocity. Again, under the influence of combined effect of viscosity, surface tension and magnetic field the bubble growth will be RMI like i.e., $\gamma \rightarrow \frac{1}{\tau}$.

[1] [1] S. Chandrasekhar, “Hydrodynamic and Hydromagnetic Stability ”, Dover New York, 1981.
[2] M. R. Gupta, L.K.Mandal, Sourav Roy and Manoranjan Khan, “Effect of magnetic field on temporal development of Rayleigh Taylor instability induced interfacial nonlinear structure”, *Physics of Plasmas*, **17**, 012306, 2010.