

Experimental study on the stability / instability of the structure of the partially molten system

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Partial melt is composite of the solid and the molten material. It is unstable to various excitation and melt segregation occurs. This process controls material differentiation and thermal transport in the Earth. Though the melt segregation has been studied, the treatment of the partial melt is confined in the low melt fraction where the partial melt behaves as a solid basically. In this study the melt segregation at the intermediate melt fraction where the deformation of the partial melt is caused not only by the deformation of the solid phase but also by the fluidization of the solid phase is treated to investigate the factor that controls the stability of the structure of the partial melt. Two contrasting experiments have been performed: (1) rheology measurements of the sample with concentric cylindrical apparatus; (2) experiment on the gravitational instability. System of highly deformable gel sphere + viscous fluid has been used as an analog material of the partial melt in this study. The behavior of the solid has been analyzed by PIV (particle image velocimetry) technique. From both experiments the differential segregation of liquid phase is found to occur in the fluidized state. This indicates that the yield strength of the composite controls the stability / instability of the structure of the composite.