Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Flow simulation for a high Prandtl number liquid heated from above[1] ERDEM UGUZ, Univ. Florida, Department of Chemical Eng., FL 32611, FRANCK PIGEONNEAU, Surface du Verre Interfaces, CNRS/St. Gobain, France, GERARD LABROSSE, Univ. Paris-Sud 11, France, RANGA NARAYANAN, Univ. Florida, Department of Chemical Eng., FL 32611, UNIVERSITY OF FLORIDA TEAM, SAINT-GOBAIN TEAM, UNIVERSITY OF PARIS-SUD 11 TEAM —
Natural convection in a glass furnace has crucial importance for glass manufacturing as it affects mixing and bubble dynamics. To understand the convective flows in a glass furnace where the Prandtl numbers typically are greater than 1000, a numerical study is performed using the spectral collocation Chebyshev method. Calculations were done for a 2D rectangular geometry for various aspect ratios (i.e. height divided by length) and Rayleigh (Ra) numbers for a constant viscosity fluid. Depending upon the value of Ra, and for a fixed aspect ratio, secondary and even tertiary transient cell formations were observed. In the process of heating (i.e. in the process of increasing Ra) thermal and velocity boundary layers are formed. Also with increasing Ra the solution becomes unstable and the critical Ra number that defines this transition has a strong dependence on the aspect ratio.

[1]Support from NSF OISE 0968313, the Partner University Fund and a Chateaubriand fellowship are acknowledged.

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Date submitted: 28 Jul 2011 Electronic form version 1.4