Abstract

A numerical study is performed to investigate the effect of the adiabatic walls emissivity on coupled double diffusive natural convection and gas radiation in a differentially heated square enclosure filled with non-gray air-H2O mixtures in a cooperating case. The vertical walls of the enclosure are maintained at two different but uniform temperatures. The remaining boundaries are thermally insulated and considered as adiabatic walls. These walls are assumed to be opaque, diffuse and gray. Their emissivity is variable (ε=0, 0.1, 0.5 and 1). The governing differential equations are solved by a finite-volume method and the SIMPLE algorithm was adopted to solve the pressure-velocity coupling. The discrete ordinates method (DOM) associated with the spectral line weighted-sum-of-gray-gases (SLW) is used to solve the radiative transfer equation. Simulations are performed in configurations where thermal and concentration gradient induces cooperating buoyancy forces. Results obtained for three average molar fractions of H2O (5%, 10% and 20%). The effects of walls emissivity on the flow and temperature fields and heat transfer rates are analyzed