

Boundary layer flow near a stagnation point on a permeable vertical surface immersed in a nanofluid

ABSTRACT

A steady mixed convection boundary layer flow near a stagnation point on a permeable vertical surface immersed in a nanofluid is investigated. The velocity of the external flow is assumed to vary linearly with the distance from the stagnation-point. The governing partial differential equations are first transformed into ordinary differential equations, before being solved numerically using the Keller box method with the help of MATLAB software. The effects of physical parameters such as the suction/injection parameter, Brownian motion parameter, thermophoresis parameter and Lewis number on the heat and mass transfer rate at the surface as well as the temperature and concentration profiles are analyzed and discussed. Both assisting and opposing flows are considered. It is found that, increasing the thermophoresis parameter, Brownian motion parameter and Lewis number are to decrease the heat transfer rate at the surface, but on the other hand increase the mass transfer rate at the surface for both assisting and opposing flows. In addition, increasing suction parameter tends to increase the heat transfer rate at the surface. However, the opposite behavior occurs for the effect of mass transfer rate at the surface.

Keyword: Boundary layer flow; Mixed convection; Stagnation point; Suction/injection; Vertical surface