

In this study, the laminar forced convection heat transfer and fluid flow characteristics of an annular pipe partly occupied with porous media are numerically investigated. The original sample considered here is the concentric clear fluid region with an aspect ratio (Ri) of 0.2. Three objectives are considered for developing the normal design, namely using eccentric clear fluid region, replacing the single clear fluid circular region by multi-circular ones having the same cross-sectional flow area, and using helical clear fluid region instead of the straight ones. The governing equations of the clear fluid zone and porous matrix zone are solved using the finite volume method. Constant wall heat flux is adopted on the outer pipe surface, and the Reynolds number is ranged from 100 to 1500. The concrete findings show that the heated wall temperature is reduced when the fluid region eccentricity increases and moves toward the wall. The maximum temperature gradient obtained is 8.6 K when one concentric fluid region is replaced by six small fluid regions distributed circumferentially having the same cross-sectional area of the original one. Moreover, around 9.1 K temperature gradient is observed when one straight fluid region is replaced by one helical fluid region having three helices.