Confined impinging nanofluid jets in porous media

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Heat transfer enhancement technology has the aim to develop more efficient systems as demanded in many applications in the fields of automotive, aerospace, electronic and process industry. A possible solution to obtain efficient cooling systems is represented by the use of confined impinging jets. Moreover, the introduction of nanoparticles in the working fluids can be considered in order to improve the thermal performances of the base fluids.

In this paper a numerical investigation on mixed convection in confined slot jets impinging on a purous media by considering pure water or Al_2O_3/water based nanofluids is described. A two-dimensional model is developed and different Peclet numbers and Rayleigh numbers were considered. The particle volume concentrations ranged from 0% to 4% and the particle diameter is equal to 30 nm. The target surface is heated by a constant temperature value, calculated according to the value of Rayleigh number. The distance of the target surface is five times greater than the slot jet width. A single-phase model approach has been adopted in order to describe the nanofluid behavior while the hypothesis of non-local thermal equilibrium is considered in order to simulate the behavior in the porous media which is featured by a porosity value of 0.87. The aim consists into study the thermal and fluid-dynamic behaviour of the system. Results show increasing values of the convective heat transfer coefficients for increasing values of Peclet number and particle concentration. This behaviour is more evident at low Peclet number values and Rayleigh number ones.