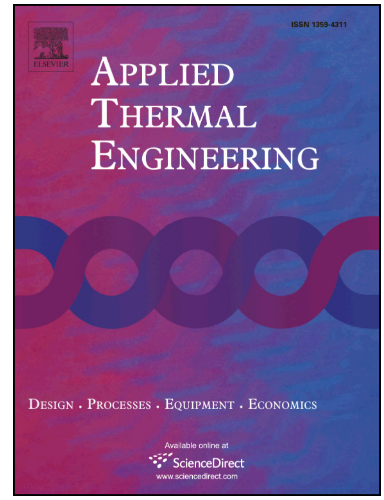

Research Paper

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Contrastive Study of Flow and Heat Transfer Characteristics in a Helically Coiled Tube under Uniform Heating and One-side Heating

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Abstract: One-side heated helically coiled tubes, which are generally applied in various industrial applications such as the water cooled wall in power plant boilers though, have not been thoroughly studied. To investigate the flow and heat transfer characteristics in this case, numerical simulation of the flow in a helically coiled tube is performed under uniform and non-uniform (heating on the inner coil side wall) heat flux boundary conditions for both laminar and turbulent flows. Temperature distributions, secondary flow distributions, average Nusselt number variation with respect to Reynolds number and local Nusselt number along the periphery on the wall in the fully developed section are discussed contrastively under the two different heating conditions. It is found that the secondary flow distributions are hardly affected by changing heating method, however, a larger temperature gradient can be found for one-side heating condition. The average Nusselt numbers are close for laminar flow under the two heating methods, but one-side heating shows 7%-10% lower average Nusselt numbers than uniform heating for turbulent flow, thus a new correlation of average Nusselt number for turbulent flow and one-side heating is proposed. Furthermore, a special point on the inner wall where the local Nusselt numbers are almost the same when carrying out different heating conditions in laminar and turbulent flows is found, which should be useful for measuring unknown parameters.

Keywords: helically coiled tube; flow and heat transfer characteristics; one-side heating condition

Nomenclature			
A	Area ($\mathrm{m^2}$)	*Greek symbols*	
b	Coil pitch (mm)	δ	Curvature ratio
Cp	Specific capacity ($\mathrm{J \cdot kg^{-1} \cdot}$	μ	Viscosity ($\mathrm{kg \cdot m^{-1} \cdot s^{-1}}$))

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