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Experimental Study on Natural Circulation Heat Transfer of Square Channel in Water Cooled Blanket

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Square channel is widely used in the conceptual design of water cooled blanket of fusion reactor for cooling and providing appropriate inner temperature field for tritium breeding. Blanket is one of the most important safety components and thermal-hydraulic characteristics of blanket directly determine the heat transfer efficiency and safe operation of fusion reactor. Under accident conditions, the natural circulation phenomenon occurs without any mechanical devices intervention when the field forces acting on the fluid produce density gradients able to induce natural convection, which is the main heat transfer mechanism and a important measure to mitigate consequence of the reactor accident. For square channel(8mm*8mm) in blanket, the experimental study of natural circulation heat transfer has been conducted. Experimental results showed that natural circulation flow was not a independent parameter, which increased with the increase of the heat flux and the decrease of system pressure within the experiment scope. Simultaneously, natural circulation heat transfer was strongly affected by system pressure and heat flux. A new correlation was developed on the foundation of experimental data, which could predict the heat transfer coefficient of natural circulation with the maximum relative error of 30%. Comparing the experimental results with the results of forced circulation, it could be found that the heat transfer coefficient of natural circulation was lower than the heat transfer coefficient of forced circulation.

Eligible for student paper award?

No

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