# Chapter 3

# Design Considerations for Compact Ceramic Offset Strip-Fin High Temperature Heat Exchangers

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*This paper deals with the development of a three-dimensional numerical model to predict the overall performance of an advanced high-temperature heat exchanger (HTHX) design, up to 1000 °C, for the production of hydrogen by the sulfur-iodine thermo-chemical cycle used in advanced nuclear reactor concepts. The design is an offset strip-fin, hybrid plate compact heat exchanger made from a liquid silicon impregnated carbon composite material. The two working fluids are helium gas and liquid salt (FLINAK). The offset strip-fin is chosen as a method of heat transfer enhancement because of its ability to induce the periodic boundary layer restart mechanism between the fins, which has a direct effect on heat transfer enhancement. The effects of the fin geometry on the flow field and heat transfer are studied in three-dimensions using Computational Fluid Dynamics (CFD) techniques, and the results are then compared with the results from the analytical calculations. The pre-processor GAMBIT is used to create a computational mesh, and the CFD software package FLUENT, which is based on the finite volume method, is used to produce the numerical results. Fin dimensions need to be chosen to optimize heat transfer and minimize pressure drop. Comparisons of the overall performance between the rectangular and curved fin geometry were performed using computational fluid dynamics techniques. The model developed in this paper will be used to investigate the heat exchanger design parameters in order to find an optimal design. Also, numerical simulation results were performed and compared to study the effect of the temperature dependent physical properties.*