Fusion Engineering and Design. Volume: Number: Pages: -.

Modeling and sizing of the heat exchangers of a new supercritical CO2 Brayton power cycle for energy conversion for fusion reactors

I. Serrano, A. Cantizano, J.I. Linares, B.Y. Moratilla

Abstract— TECNO_FUS is a research program financed by the Spanish Government to develop technologies related to a dual-coolant (He/Pb-Li) breeding blanket design concept including the auxiliary systems for a future power reactor (DEMO). One of the main issues of this program is the optimization of heat recovery from the reactor and its conversion into electrical power. This paper is focused on the methodology employed for the design and sizing of all the heat exchangers of the supercritical CO2 Brayton power cycle (S-CO2) proposed by the authors. Due to the large pressure difference between the fluids, and also to their compactness, Printed Circuit Heat Exchangers (PCHE) are suggested in literature for these type of cycles. Because of the complex behavior of CO2, their design is performed by a numerical discretization into sub-heat exchangers, thus a higher precision is reached when the thermal properties of the fluids vary along the heat exchanger. Different empirical correlations for the pressure drop and the Nusselt number have been coupled and assessed. The design of the precooler (PC) and the low temperature recuperator (LTR) is also verified by simulations using CFD because of the near-critical behavior of CO2. The size of all of the heat exchangers of the cycle have been assessed.

Index Terms— CFD; Dual coolant blanket; Printed Circuit Heat Exchanger; Supercritical CO2 cycle

Citation:
Serrano, I.; Cantizano, A.; Linares, J.I.; Moratilla, B.Y.; "Modeling and sizing of the heat exchangers of a new supercritical CO2 Brayton power cycle for energy conversion for fusion reactors", Fusion Engineering and Design, vol., no., pp.-. , .