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NOBLE GAS, BINARY MIXTURES FOR COMMERCIAL GAS-COOLED REACTOR SYSTEMS**Mohamed S. El-Genk and Jean-Michel Tournier**

Institute for Space and Nuclear Power Studies and Chemical and Nuclear Engineering Dept.

The University of New Mexico, Albuquerque, NM 8713, USA

(505) 277 – 5442,

E-mail: mgenk@unm.edu**ABSTRACT**

Commercial gas cooled reactors employ helium as a coolant and working fluid for the Closed Brayton Cycle (CBC) turbo-machines. Helium has the highest thermal conductivity and lowest dynamic viscosity of all noble gases. This paper compares the relative performance of pure helium to binary mixtures of helium and other noble gases of higher molecular weights. The comparison is for the same molecular flow rate, and same operating temperatures and geometry. Results show that although helium is a good working fluid because of its high heat transfer coefficient and significantly lower pumping requirement, a binary gas mixture of He-Xe with $M = 15$ gm/mole has a heat transfer coefficient that is ~7% higher than that of helium and requires only 25% of the number stages of the turbo-machines. The binary mixture, however, requires 3.5 times the pumping requirement with helium. The second best working fluid is He-Kr binary mixture with $M = 10$ gm/mole. It has 4% higher heat transfer coefficient than He and requires 30% of the number of stages in the turbo-machines, but requires twice the pumping power.