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Enhanced arrangement for recuperators in supercritical CO2 Brayton power cycle for energy conversion in fusion reactors

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Abstract— A domestic research program called TECNO_FUS was launched in Spain in 2009 to support technological developments related to a dual coolant breeding blanket concept for fusion reactors. This concept of blanket uses Helium (300 °C/400 °C) to cool part of it and a liquid metal (480 °C/700 °C) to cool the rest; it also includes high temperature (700 °C/800 °C) and medium temperature (566 °C/700 °C) Helium cooling circuits for divertor. This paper proposes a new layout of the classical recompression supercritical CO2 Brayton cycle which replaces one of the recuperators (the one with the highest temperature) by another which by-passes the low temperature blanket source. This arrangement allows reaching high turbine inlet temperatures (around 600 °C) with medium pressures (around 225 bar) and achieving high cycle efficiencies (close to 46.5%). So, the proposed cycle reveals as a promising design because it integrates all the available thermal sources in a compact layout achieving high efficiencies with the usual parameters prescribed in classical recompression supercritical CO2 Brayton cycles.

Index Terms— Brayton cycle; Dual coolant blanket; Power conversion system; Recompression Brayton cycle; Supercritical CO2 cycle

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