Accelerator-Driven Thorium Cycle: New Technology Makes It Feasible

Abstract

We have developed a conceptual design for an accelerator-driven thorium cycle power reactor which addresses the issues of accelerator performance, reliability, and neutronics that limited earlier designs. The proton drive beam is provided by a flux-coupled stack of isochronous cyclotrons, occupying the same footprint as a single cyclotron but providing 7 independent beams from 7 separate accelerating structures within a common magnetic envelope. The core is arranged in a hexagonal lattice, and the 7 beams are used to provide a hexagonal drive beam pattern so that the effective neutron gain is relatively uniform over the entire core volume. Reliability is achieved by redundancy: if any drive beam is interrupted, the other 6 suffice to maintain reactor operation. A new approach to fuel cladding should make it possible to operate with lead moderator at temperatures {approx} 800 C, enabling access to advanced heat cycles and perhaps to a Brayton cycle for hydrogen production. (authors)

Adams, Marvin; Best, Fred; Kurwitz, Cable; McInturff, Al; McIntyre, Peter; Rogers, Bob; Sattarov, Akhdior; Wu Zeyun;Yavuz, Mustafa [Texas A and M University, College Station, TX 77843 (United States)]; Meitzler, Charles [Dept. of Physics, Sam Houston State University, Huntsville, TX 77341 (United States)]

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