

Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

The Dynamak: An advanced spheromak reactor system with imposed-dynamo current drive and next-generation nuclear power technologies D.A. SUTHERLAND, T.R. JARBOE, G. MARKLIN, K.D. MORGAN, B.A. NELSON, University of Washington — A high-beta spheromak reactor system has been designed with an overnight capital cost that is competitive with conventional power sources. This reactor system utilizes recently discovered imposed-dynamo current drive (IDCD) and a molten salt blanket system for first wall cooling, neutron moderation and tritium breeding. Currently available materials and ITER developed cryogenic pumping systems were implemented in this design on the basis of technological feasibility. A tritium breeding ratio of greater than 1.1 has been calculated using a Monte Carlo N-Particle (MCNP5) neutron transport simulation. High-temperature superconducting tapes (YBCO) were used for the equilibrium coil set, substantially reducing the recirculating power fraction when compared to previous spheromak reactor studies. Using zirconium hydride for neutron shielding, a limiting equilibrium coil lifetime of at least thirty full-power years has been achieved. The primary FLiBe loop was coupled to a supercritical carbon dioxide Brayton cycle due to attractive economics and high thermal efficiencies. With these advancements, an electrical output of 1000 MW from a thermal output of 2486 MW was achieved, yielding an overall plant efficiency of approximately 40%. A paper concerning the Dynamak reactor design is currently being reviewed for publication.

D.A. Sutherland
University of Washington

Date submitted: 11 Jul 2013

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