

Abstract Submitted
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Ohmic ignition with high engineering beta based on the RFP

J.S. SARFF, J.K. ANDERSON, B.E. CHAPMAN, K.J. MCCOLLAM, Univ. Wisconsin-Madison — The RFP configuration allows the possibility of ohmic ignition for fusion energy, eliminating the need for auxiliary heating by rf or neutral beam injection. Complex plasma-facing antennas and NBI sources are therefore not required, simplifying the difficult fusion materials challenge. While all toroidal configurations require a volume-average $\langle B \rangle \geq 5\text{T}$, the field strength at the magnet in the RFP is only $B_{\text{coil}} \approx 3\text{T}$ since plasma current generates almost all of the field. Engineering beta is therefore maximized. We summarize access to ohmic ignition by examining a Lawson-like power balance for an RFP fusion plasma comparable to the ARIES-AT advanced tokamak, which generates neutron wall loading $P_n/A \approx 5\text{MW/m}^2$. The required energy confinement for ohmic ignition in an RFP is similar to that for a tokamak. Confinement in MST is comparable to a same-size, same-field tokamak plasma, but $\langle B \rangle$ in MST is only 1/20th that required for fusion. While transport could ultimately be dominated by micro turbulence, extrapolation of stochastic transport using Lundquist number scaling for MHD tearing indicates standard RFP confinement (not enhanced by current profile control) could be sufficient to access ohmic ignition. This bolsters the possibility for steady-state inductive sustainment using oscillating field current drive. The high beta and classical energetic ion confinement measured in MST also bolster the RFP's fusion potential. Work supported by U.S. DoE.

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