Aspects of Advanced Fuel FRC Fusion Reactors

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This talk will focus on aspects of p^{11}B and D^{3}He FRC fusion reactors in comparison with DT FRC and tokamak reactors. Developing attractive fusion power requires overcoming physics, engineering, safety, economic, and environmental obstacles. Low-neutron advanced fuels in combination with high-β concepts appear very attractive from the perspectives of engineering, safety, environment, and licensing, while cost remains to be determined. With regard to energy confinement, DT fuel is the easiest to burn, while burning advanced fuels requires continued, modest plasma physics progress, especially in energy confinement, along with development of the FRC or another suitable high-β innovative concept. Unfortunately, DT fuel faces daunting engineering obstacles, including tritium-breeding blanket design, neutron damage to materials, radiological hazard (afterheat and waste disposal), and frequent maintenance in a highly radioactive environment. The geometry of FRCs (Figure 1) also leads to significant engineering advantages over the tokamak related to power flows, direct energy conversion, magnet configuration, radiation shielding, coolant piping accessibility, and maintenance. This talk will summarize the issues mentioned above, and also discuss fusion power density, plasma-surface interactions, nuclear proliferation, non-electric applications, and ^{3}He fuel supply.

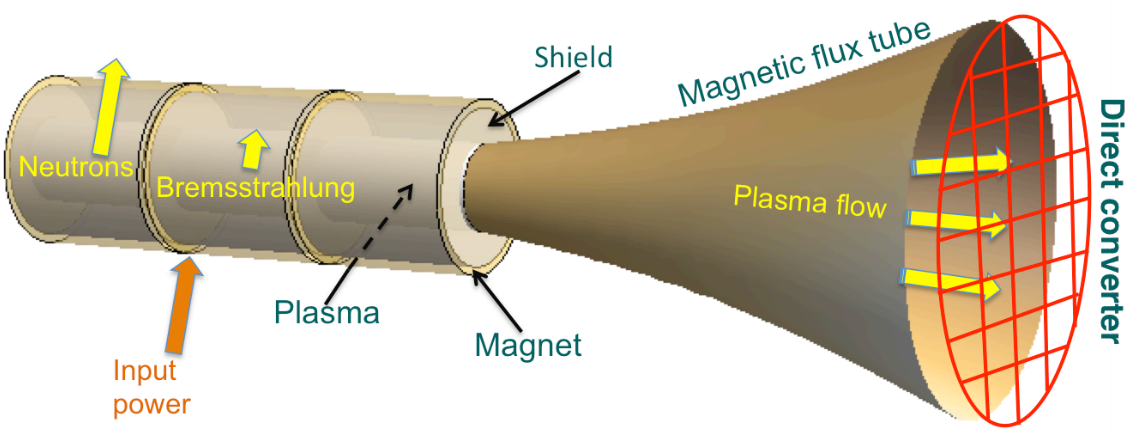

Figure 1. FRC fusion core key elements and major power flows.