# Foreword

## Special section on Advanced Fusion Concepts

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*Editor*

This special section of *Fusion Science and Technology* features work on modeling, manufacturing, and experiments that may enable the advancement of the current state of the art and improve fusion technology development. We begin with two theoretical works focusing on the plasma edge, which feature models for toroidal velocity calculation and fluid transport. Following this, we turn to experimental work: an examination of advanced manufacturing of steels for fusion reactors and equations of state measurements of compressible magnetized plasmas.

In "A Composite Neoclassical Toroidal Viscosity Model Incorporating Torques from both Axisymmetric and Nonaxisymmetric Tokamak Magnetic Fields," Stacey presents a composite axisymmetric and non-axisymmetric neoclassical viscous torque model for plasma rotation calculations. In this work, the author builds the model, places it in context of other related methods of plasma core and edge analysis, and describes for the reader how calculations may benefit from its use.

As a complement to the work on toroidal viscosity modeling, Stacey presents a comprehensive fluid transport model in "A Particle-, Momentum-, and Energy-Conserving Fluid Transport Theory for the Tokamak Plasma Edge." The author develops for the reader a fluid theory for the radial particle and energy fluxes and the radial distributions of pressure, density, rotation velocities, and temperatures in the edge plasma. Corrections from ion orbit loss are incorporated into the fluid equations and examined in the context of the edge pedestal profile.

Following these two theoretical papers, we have a development of the potential uses of advanced manufacturing in ferritic-martensitic steels for fusion applications. In "A Road Map for the Advanced Manufacturing of Ferritic-Martensitic Steels," Sridharan and Field lay out the different advanced manufacturing approaches under evaluation at Oak Ridge National Laboratory. This work takes us through alloy composition, additive processes, processing conditions, and the resulting materials properties from wire- and powder-based techniques. The authors examine the effects on microstructure and further suggest strategies to realize fusion-specialized alloys using advanced manufacturing processes.

We conclude this special section with a discussion of measurements of plasma parameters in a magneto-inertial fusion experiment. In "Magnetothe-rmodynamics in SSX: Measuring the Equations of State of a Compressible Magnetized Plasma," Brown and Kaur investigate the equations of state of a compressed magnetized plasma. The authors identify ion heating events during compression through a pressure-volume diagram constructed using measured density, temperature, and volume. They compare measurements to predicted magnetohydrodynamic and double adiabatic equations of state, concluding that their results better match the parallel adiabatic model. The authors present their conclusions by evaluating their results in context of this model.

This special section is aimed at the fusion technology and science community at large and touches on several areas of wide interest. It is my hope that it will stimulate interesting conversation, new ideas, and fruitful research avenues. Happy reading!