High temperature superconductors as an enabling technology for fusion energy

Brandon Sorbom[2]

[1] *Commonwealth Fusion Systems*
[2] *Massachusetts Institute of Technology*

MIT and Commonwealth Fusion Systems (CFS), a company focused on the rapid commercialization of fusion, are jointly pursuing a privately-funded, accelerated approach to demonstrate the feasibility of compact fusion energy using high-temperature superconductors. The CFS/MIT team has developed high-field, large-bore, REBCO-based superconducting magnets to incorporate into a compact net-energy tokamak called SPARC that will demonstrate commercially-relevant net fusion energy gain. The key performance metrics in a tokamak scale as the strength of the toroidal magnetic field to the third or fourth power. One of the most important consequences of these scalings is that increasing the magnetic field in a tokamak enables a much smaller device to demonstrate net-energy production, leading to dramatic reductions in cost, timeline, and organizational complexity required to construct and operate the fusion device. Following the successful demonstration of a large-bore, 20 T, all-REBCO magnet in September 2021, SPARC has begun construction and will be commissioned in 2025.