

Overcoming the Challenges of the ITER Magnets

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Abstract— The ITER magnet system represents by far the largest superconducting magnet system ever constructed. When the design was finalized over 15 years ago, we had to make many judgements on how superconducting technology would develop over the construction period and how we could balance the need to exploit the advantages of the latest developments with the need for high reliability and essentially a conservative design. The construction is still on-going and final confirmation that the judgements were sound will only come at the start of ITER operation in 2026. However as we are now transiting from the first-of-a-kind stage to the serial production of the magnets, we can look at the main challenges we have overcome, where unforeseen behavior in the technology required a pro-active response and design/manufacturing adjustments to maintain the magnet performance. At this time we have completed most of the design and manufacturing qualification activities which provide a good preview of the final performance we can expect from the coils. In this presentation as well as providing an overview of the manufacturing status, we will focus on a few of these individual challenges, including the adapting to changes in the magnet operating conditions (with additional nuclear heating and faster current ramp rates), conductor fabrication and performance (measured in conductor samples and then the CS and TF insert coils), the TF coil double pancake production, the pre-compression rings, and the TF coil mechanical structures.

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