

Korean artificial sun, KSTAR, completes divertor upgrades for long pulse operations

December 29 2023

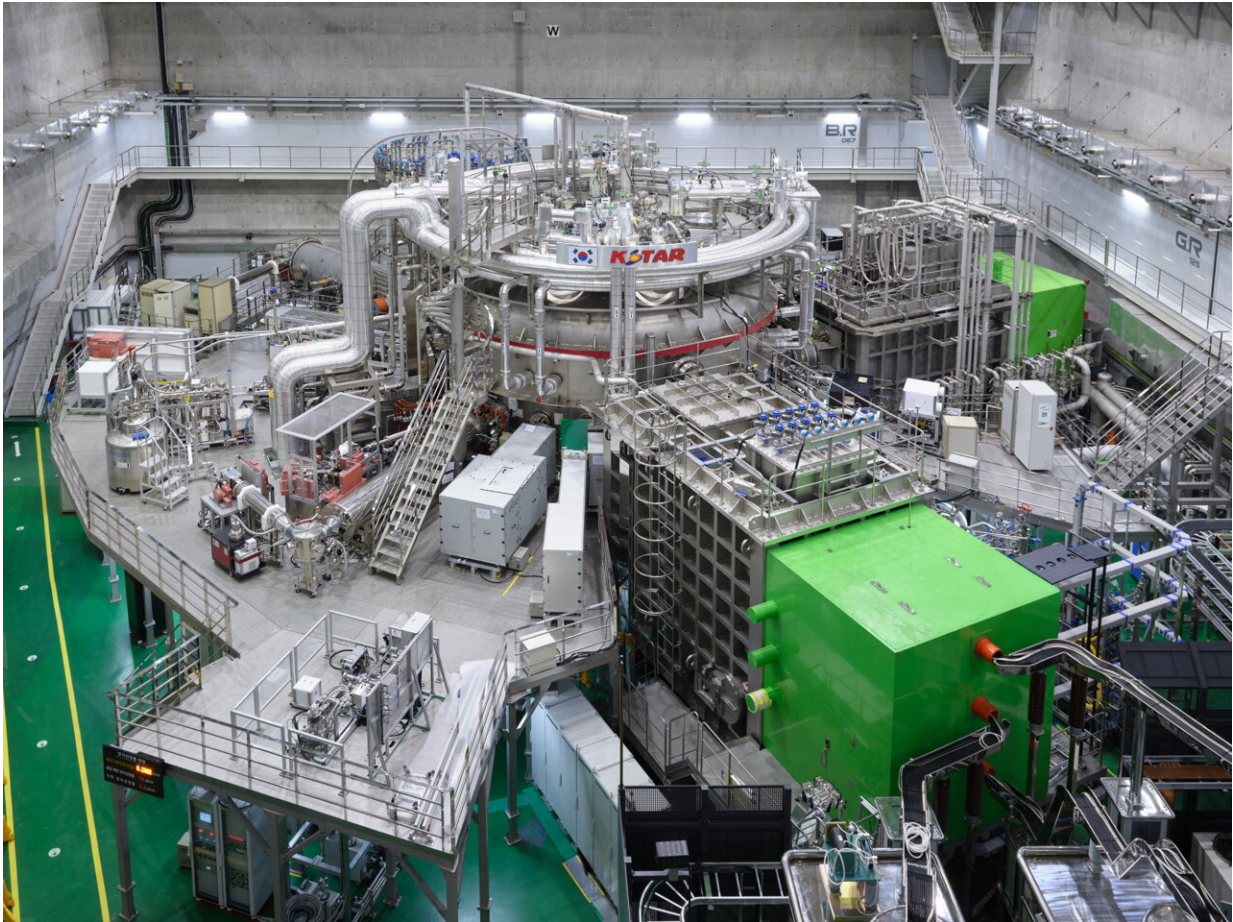


Photo of KSTAR (Korea Superconducting Tokamak Advanced Research).
Credit: Korea Institute of Fusion Energy (KFE)

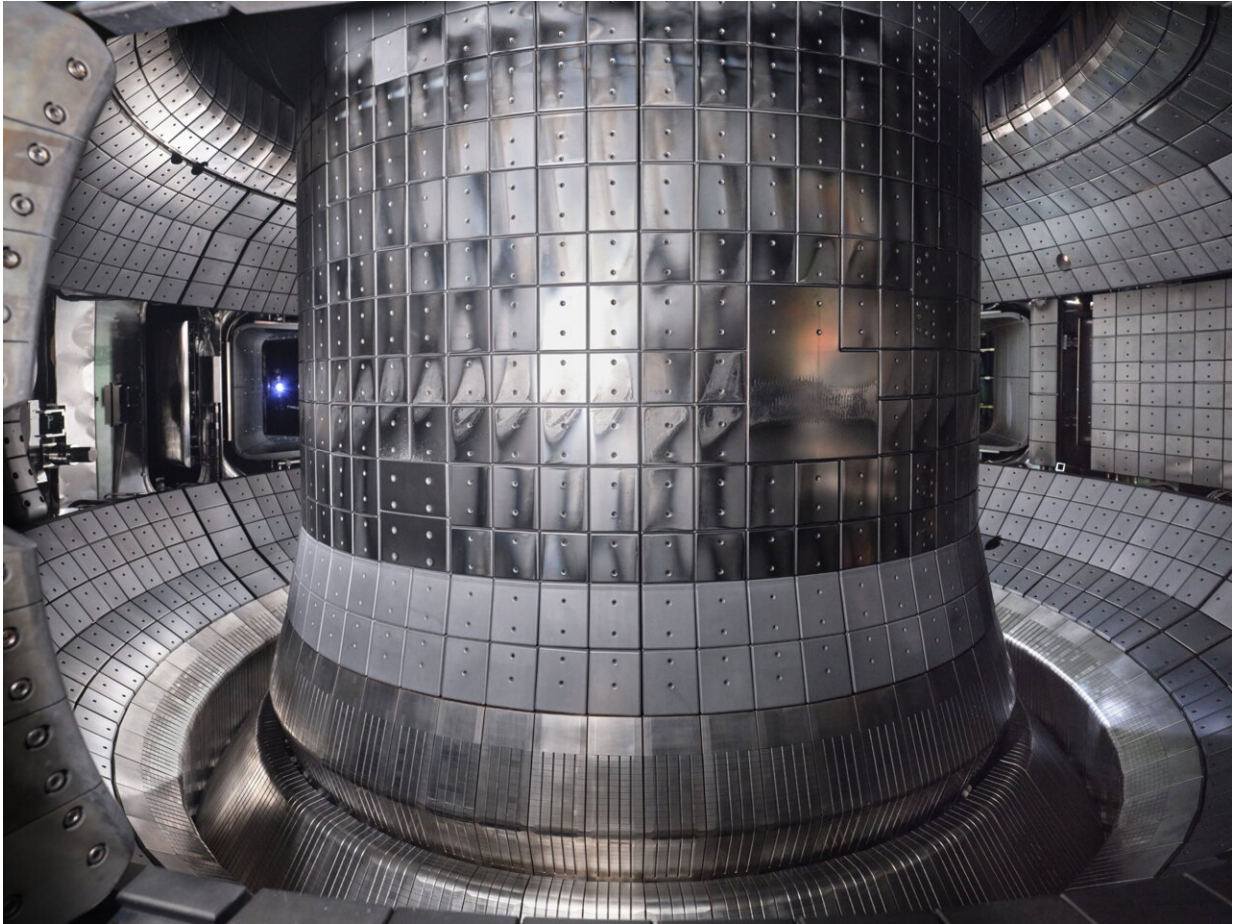
The Korean artificial sun, KSTAR, has completed divertor upgrades, allowing it to operate for extended periods sustaining high-temperature plasma over 100 million degrees.

The Korea Institute of Fusion Energy announced the successful installation of the newly developed [tungsten](#) divertor for KSTAR. KSTAR, now equipped with the new divertor, commenced a [plasma](#) experiment on the 21st of December 2023.

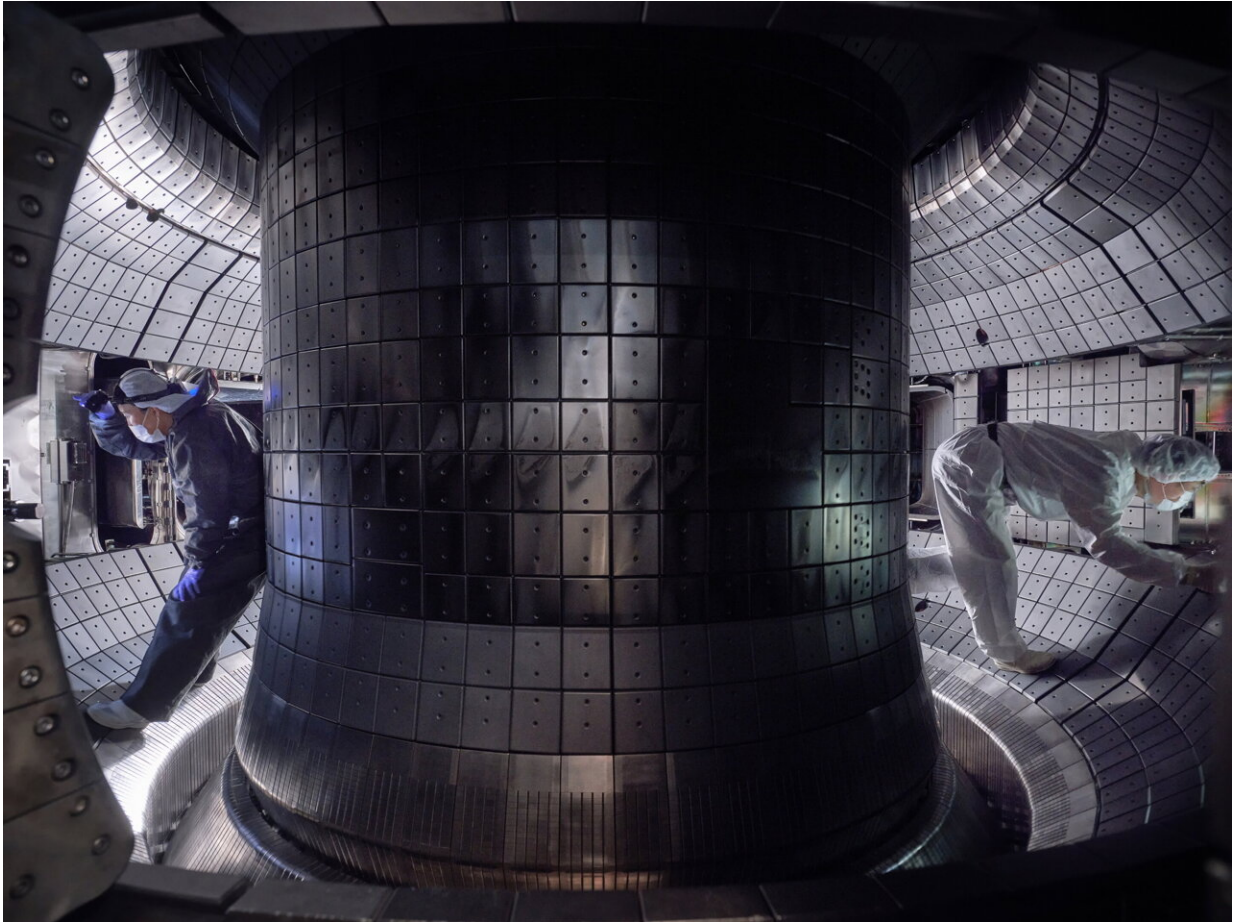
The divertor, a crucial plasma-facing component installed at the bottom of the vacuum vessel in a magnetic fusion device known as a Tokamak, manages the exhaust of waste gas and impurities from the reactor and also endures the highest surface heat loads. This is why it is important to develop and deploy a divertor that is highly heat-resistant.

Initially, KSTAR had a carbon divertor, but for KSTAR's enhanced performance and prolonged [operations](#) at 100 million °C, the [heat flux](#) exceeded the limit of the carbon divertor.

Consequently, the development of a divertor using tungsten has begun in 2018. The first prototype was completed in 2021, and installation of a new divertor took place starting September 2022 and lasted for approximately one year. The recently installed divertor consists of 64 cassettes, each crafted from tungsten mono-blocks. These 64 cassettes fully surround the bottom of the vacuum vessel.



KSTAR Vacuum vessel. Credit: Korea Institute of Fusion Energy (KFE)



KSTAR Vacuum vessel. Credit: Korea Institute of Fusion Energy (KFE)

Tungsten material possesses a [high melting point](#) and low sputtering characteristics. Therefore, the heat flux limit has improved by over two-fold compared to the carbon divertor, reaching 10 MW/m^2 .

The plasma experiments of KSTAR in the new tungsten divertor environment will continue until February 2024. The primary objectives include verifying stable operations in the new tungsten divertor environment and reproducing KSTAR's 100-million-degree plasma.

KFE President, Dr. Suk Jae Yoo stated, "In KSTAR, we have

implemented a divertor with tungsten material which is also the choice made in ITER. We will strive to contribute our best efforts in obtaining the necessary data for ITER through KSTAR experiments."

Previously, KSTAR has demonstrated high performance plasma operation for 30 seconds with an ion temperatures over 100 million [degrees](#), and now the goal is to achieve 300 seconds by the end of 2026 with this new divertor.

More information: www.kfe.re.kr/eng

Provided by National Research Council of Science and Technology

Citation: Korean artificial sun, KSTAR, completes divertor upgrades for long pulse operations (2023, December 29) retrieved 9 May 2024 from <https://phys.org/news/2023-12-korean-artificial-sun-kstar-divertor.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--