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Magnetic alloy core loaded 2nd harmonic cavity design and testing for CSNS-II RCS

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In this report, we present our recent progress in the design and high-power testing of the 2nd harmonic cavity for the China Spallation Neutron Source upgrade project. To achieve optimal performance, high-performance magnetic alloy (MA) cores with dimensions of $\Phi 850\text{mm} \times \Phi 316\text{mm} \times 25\text{mm}$ were meticulously developed and fabricated to serve as the load material for the radio-frequency (RF) cavity. Through rigorous testing, we were able to achieve a remarkable cavity accelerating gradient of over 40 kV/m under 15% duty cycle. To ensure optimal cooling efficiency, we conducted a comprehensive fluid dynamics simulation analysis and verified our results through experiments. Finally, to assess the long-term stability and performance of the cavity, we conducted a series of extended operation tests. These experiments successfully confirmed the high-performance capabilities and exceptional stability of the 2nd harmonic cavity.

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Footnotes

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