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Finite element analysis for NEG coated vacuum chamber based on ANSYS Workbench

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The Hefei Advanced Light Facility (HALF) is a diffraction limited storage ring (DLSR) being constructed. As the main component of the storage ring vacuum system, the vacuum chamber transports the beam and withstands the thermal effect of synchrotron radiation simultaneously. The thermal and mechanical condition of the vacuum chamber of HALF were quantitatively analysed by means of ANSYS WORKBENCH in this work. Combining the Computational Fluid Mechanics (CFD) and Finite Elements Analysis (FEA), the temperature and thermal stress maps of the vacuum chamber were calculated. The CFD calculation displays that the heat transfer coefficient between the water and the chamber is 7966-13093 W/(m2·℃). The thermal-mechanical simulation shows that the maximum temperature and thermal stress are 53.5 ℃ and 42.1 MPa, respectively. The static structural analysis was performed on vacuum chamber under the ultra-high vacuum condition, with the maximum stress of 1.7 MPa and the maximum deformation of 0.0003 mm. These results show that the vacuum chamber meets the design requirements and provide a critical theoretical basis for the design of the vacuum system of HALF.

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Footnotes

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