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High heat load annealed pyrolytic graphite filter for the material science beamline at SESAME

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The Materials Science Beamline has historically relied on a rotating filter system for beam attenuation, which introduced mechanical complexity, risk of failure, thermal instabilities, and high outgassing during conditioning. To address these limitations, we have developed a new fixed filter assembly using annealed pyrolytic graphite, chosen for its excellent thermal conductivity and low outgassing characteristics. By eliminating moving parts, the fixed filter improves mechanical stability and reduces operational interruptions. A comprehensive Finite Element Analysis (FEA) was conducted to evaluate the thermal and structural performance of the filter under both nominal and worst-case beam power densities. The results show that the design maintains acceptable thermal gradients and mechanical stresses, ensuring long-term structural integrity and minimal distortion. This work presents the design methodology, material selection criteria, FEA simulation setup, and resulting performance data, demonstrating the viability of the fixed filter concept for high heat load applications.

Footnotes

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