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Evaluation of 3D-printed plastics for ultra-high vacuum applications: outgassing and residual gas analysis

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The demand for cost- and time-effective and customizable components for High Vacuum (HV) and Ultra-High Vacuum (UHV) has prompted exploration into the application of 3D-printing technology. This study investigates the viability of utilizing 3D-printed plastics in UHV by evaluating their outgassing. An extensive evaluation of 3D-printing materials was carried out, highlighting the best polymer candidates using two of the most common 3D-printing techniques, Fused Deposition Modelling and Stereolithography. Further investigations were conducted to assess the performance of select 3D-printed plastics under UHV, focusing on their low outgassing and resistance to baking temperatures. Furthermore, residual gas analysis was used to evaluate the materials compatibility with NEG coating and possible presence of other contaminants. The findings suggest that certain 3D-printed plastics exhibit promising characteristics for use in HV and UHV, with notable examples including cyclic olefin copolymer and PEEK along with Rigid 10K and Tullomer™. A comparison between machined and 3D-printed parts showed that challenges such as porosity and surface roughness are not to be a cause of great concern.

Footnotes

Paper preparation format

Region represented

Europe

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