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Advances in Nitinol Laser Cutting: Exploring Mixed Gas Applications and Process Optimization

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Abstract: *Nitinol, a shape memory alloy widely used in biomedical and aerospace industries, requires precise fabrication techniques such as laser cutting to maintain its unique properties. Mixed gas environments have demonstrated potential in enhancing the efficiency and quality of laser cutting processes, but their role remains insufficiently explored. This review investigates advancements in Nitinol laser cutting, focusing on mixed gas applications and process optimization through bibliometric analysis of studies till 2025. Key trends highlight the growing use of reactive gases for improved energy absorption and inert gases for superior surface quality, but challenges persist in standardizing methodologies and addressing scalability. Unanswered questions include the environmental impact of gas mixtures and their effects on long-term material performance. Recommendations emphasize integrating real-time monitoring, machine learning, and sustainable gas technologies for future research.*

Keywords: Nitinol, Laser Cutting, Mixed Gas Applications, Process Optimization, Shape Memory Alloys, Reactive and Inert Gases, Thermal Effects, Surface Quality, Microstructural Integrity, Advanced Manufacturing Techniques

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