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Additive manufacturing and post processing of NiTi for intracranial stents providing complex geometries

Nickel-Titanium is a commonly used alloy in medical technology for the manufacture of stents because of its pseudoelasticity. Typical manufacturing processes for NiTiNOL (NiTi) stents are laser cutting from a tube or plate or braiding by weaving thin wires together to form a mesh-like structure. The production of complex stent geometries is costly and time-consuming, often restricted to tubular outer geometries due to manufacturing constrains. Consequently, conventional stents are limited in their possibility and effectiveness for the treatment of complex aneurysms. Additive manufacturing of NiTi offers the potential to realize appropriate stents, the entire manufacturing and post-processing process must be evaluated and established accordingly.

This given study presents the results of investigations of the LPBF process and suitable post processing steps on the material using optical, thermal and mechanical methods. It focuses specifically on thin structures with feature sizes of around 100 – 300 µm in the as-built state whose manufacturing and behavior can differ from those of compact, bulk material. The results show the influence of different orientations and scan parameters on the material properties in the as-built state as well as the effect of mechanical, chemical and thermal post processing steps. This research provides a foundation for the understanding of LPBF manufacturing and finishing of stent-like complex thin superelastic NiTi structures.