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Manufacturing of Ti–6Al–4V Micro-Implantable Parts Using Hybrid Selective Laser Melting and Micro-Electrical Discharge Machining

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The advent in micro/nano electromechanical systems (MEMS/NEMS) has been the main thrust for the advance-ment of high-performance miniaturized systems. In addition, the application of micro manufacturing technologies to biomedical engineering has presented a novel generation of small devices that helped in both medical research and treatment.^[1–6] For example, lab on a chip and micro-implant systems allowed the reduction in power consumption, electronic noise, and system complexity and capability. However, the materials used in these systems must be biocompatible and able to work in vivo. Popular examples of biocompatible materials include silicon, polymers, and glass. Many biocompatible metals have been also used in micro-implants such as titanium alloys, nitinol, platinum, and stainless steel.^[7,8] A remarkable advantage of metals over silicon-based materials and ceramics is their high strength, eliminating the chance of encountering a failure during service. They also showed outstanding stability in vivo and good impermeability. Therefore, they have been the main

choice of hermetic seals of large biomedical implants such as pacemakers.^[9,10]

Soft lithography, micro electroforming, and micro gel casting are techniques used to manufacture metal micro-parts. These techniques have been implemented to produce parts with the desired precision and surface quality.^[2,11,12] Selective laser melting (SLM) is one of the additive

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