

Surface Finishing of 17-4PH Steel Produced via Binder Jetting: a Comparison Between Mass Finishing and Electron Beam Techniques

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Binder Jetting (BJT) is an additive manufacturing technique characterized by the consolidation of 3D printed parts through sintering, rather than by the use of collimated energy beams, as is typical in other AM technologies. This study investigates the feasibility of applying the BJ process for the production of surgical instruments for orthopedic applications, as an alternative to conventional CNC machining. The project focuses on printing topology, mechanical properties of the manufactured components, and the effectiveness of various surface finishing techniques. Parts produced via BJT typically exhibit surface roughness on the order of tens of micrometers, which is unsuitable for surgical applications. A set of samples was BJT produced using a Desktop Metal Shop System 3D printer (Aidro S.r.l.) with 17-4PH stainless steel powder (D90 = 50 μm , layer thickness = 75 μm). This work presents the results of surface finishing treatments carried out using:

- a) Centrifugal High-Energy Disk Machine (FKS 02, Rösler Italiana S.r.l.);
- b) Low-Energy High-Current Electron Beam (RITM, Microsplayv OOO).

MF acts simultaneously on multiple parts with processing times on the order of several hours, while LEHCEB operates in vacuum, treating parts in a matter of minutes. Moreover, LEHCEB provides the added benefits of removing contamination and compacting the top surface layer

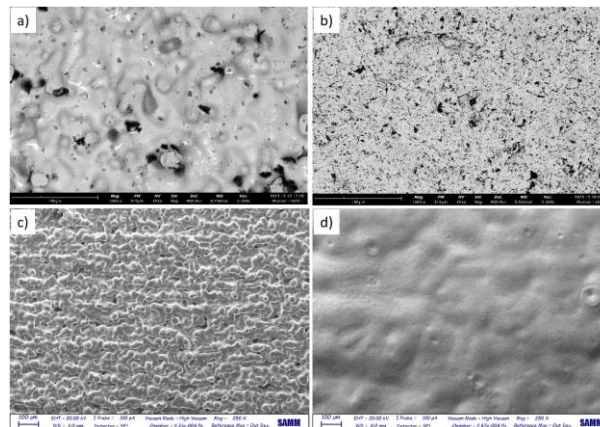


Figure 1. SEM surface morphology of a sample printed with horizontal orientation (a,b) processed by mass finishing and with vertical orientation (c, d) processed by electron beam.