



INTERNAL CHANNEL SURFACE FINISHING

Fabrication of geometrically complex internal channels is a substantial benefit provided by powder-based additive manufacturing (AM) processes such as laser powder bed fusion (L-PBF) and laser blown powder directed energy deposition (LP-DED). The ability to produce components in a single forming process that may have otherwise required the management and combination of multiple (perhaps dozens) of individual part numbers via multiple joining operations can yield substantial cost and lead time savings. But, powder-based AM processes tend to suffer from high degrees of granular roughness and/or surface texture that can lead to issues with part cleanliness, particle shedding, and/or pressure drop. These issues must be addressed in order to capitalize on the potential of AM.

These Ti-6Al-4V L-PBF channel specimens were produced on behalf of QuesTek Innovations and a subset of these specimens were subsequently processed by REM Surface Engineering's Extreme ISF[®] Chemical Polishing (CP) process to evaluate the potential to reduce as-printed surface roughness/texture and remediate potential issues linked to this roughness.

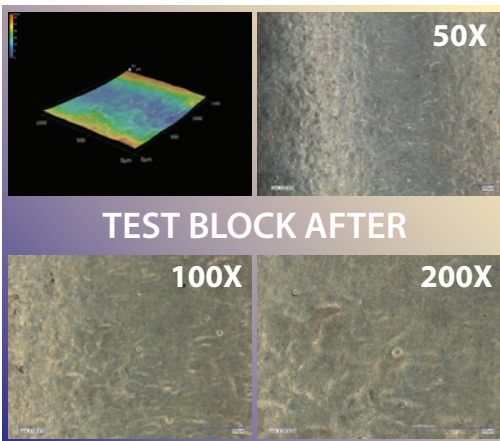
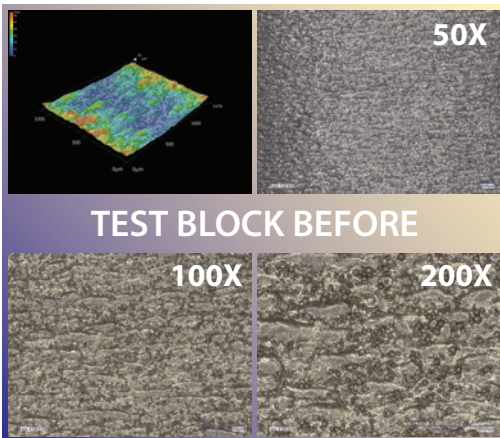
REM's CP process was able to reduce surface roughness and completely eliminate all granular texture. Initial surface roughness values of 7 – 10 μm Ra were reduced to $<2 \mu\text{m}$ Ra by REM's CP process. This surface modification results in the complete elimination of partially sintered or melted particles and any associated particle shedding/cleanliness issues. Additionally, REM's CP process was able to substantially reduce pressure drop on these small diameter applications. REM's CP process for internal channels can be applied to challenging L/D applications such as those used for liquid rocket engine cooling channels, fuel injectors, and the like, while maintaining tight feature tolerance and shape.

QuesTek Innovations

QuesTek is an advanced manufacturing consulting company focused on using their proprietary Materials by Design(r) approach to enable rapid alloy development to address novel product needs, accelerate new alloy insertion into existing products, and novel alloy development to increase components performance.

REM Surface Engineering

REM is a leading surface finishing/polishing technology supplier to both traditional and metal additive manufacturing markets. REM is a supplier to NASA MSFC, NASA JPL, the US Army, the US Air Force, the US Navy, and dozens of premier commercial customers who require the highest degree of surface finishing and quality control.



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