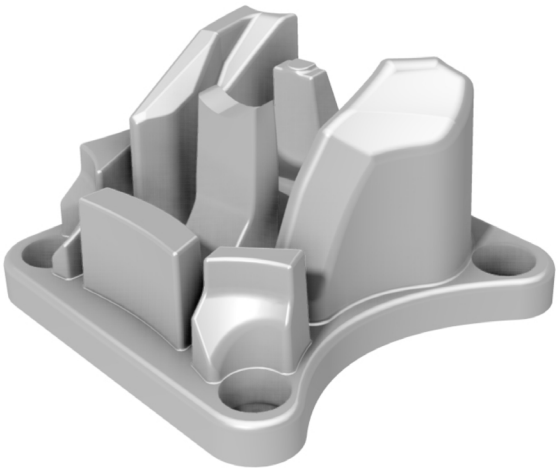
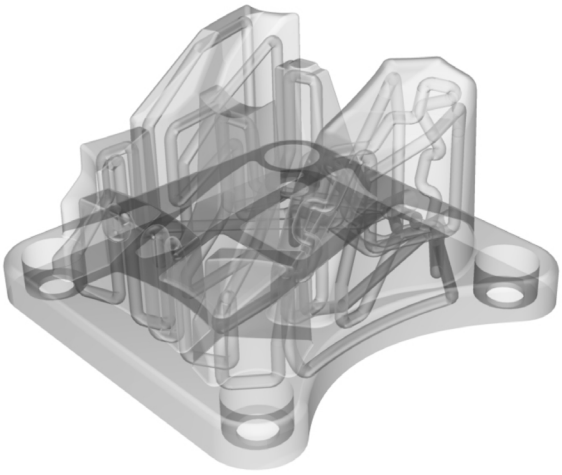
Efficient and fully automatic finishing of internal passages

AM solutions





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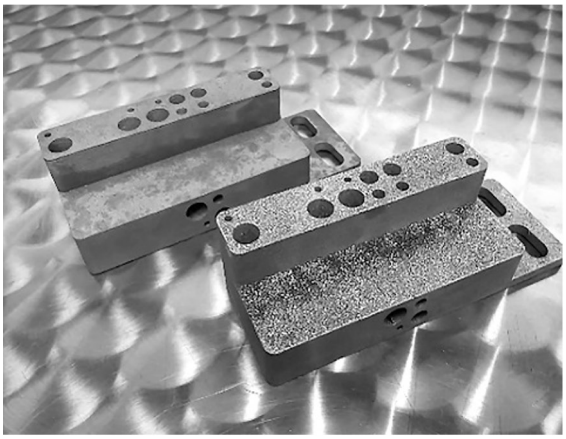
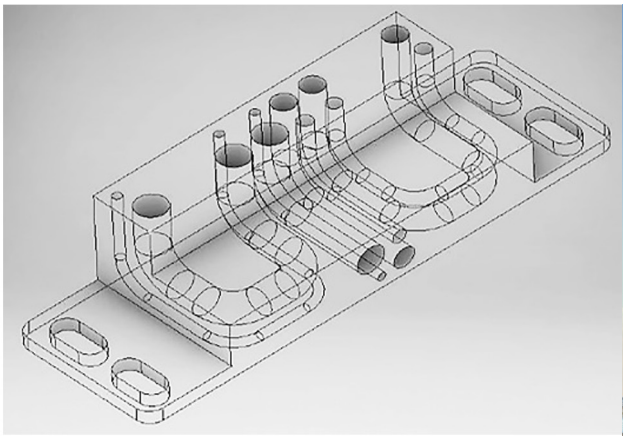
Sector: metalworking
Reto: efficient and automatic finishing of hard-to-reach internal passages that previously could not be processed or required a high degree of manual labor.

Solución: development of the M3 system, which allows the effective and specific treatment of internal passages with a fully automated system for 3D printed components.

CHALLENGE

Additive manufacturing (AM) makes possible to produce component geometries that are not possible with other conventional technologies, such as being able to create internal cooling channels in tool and die making, where thermal fluctuations during the cooling phase increase the risk of part deformation. Through additive manufacturing, we benefit among others, from a considerable reduction in cooling times. The challenge for AM Solutions (a brand of the Rösler group), was to verify that our post-processing technologies, can optimize the surface characteristics of the internal channels, as well as the general contour of the component in an automated way and reducing costs, such as the necessary labor for post-processing, obtaining an improvement in the overall performance of the part.



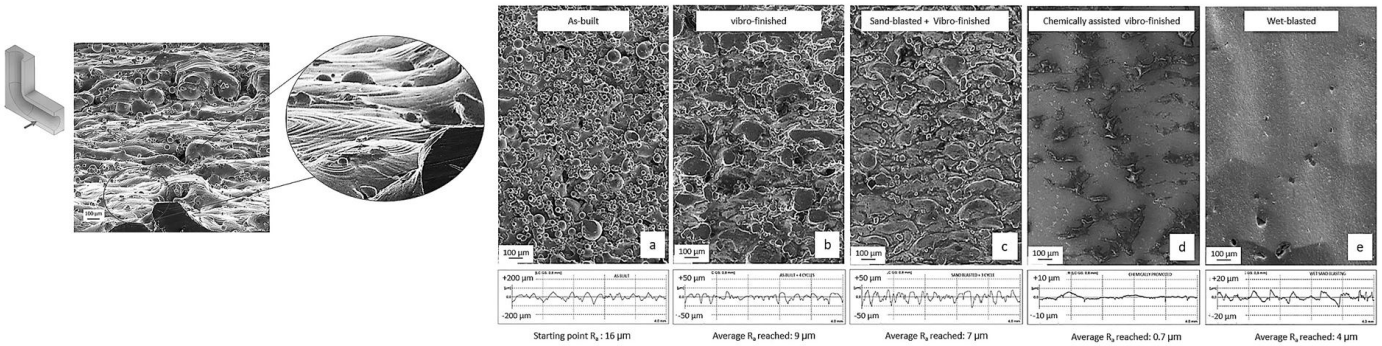


3D printing is ideal for fabrication of components, but it leaves roughness and residual dust from the process. It needs post-processing.

SOLUTION

With the focus on automated post processing, removal of residual powder and surface smoothing of these channels, the mechanical and chemical engineering departments of the Politecnico Milano (Italy) together with Rösler conducted a study with the surface treatment methods mass finishing, shot blasting and chemically supported mass finishing. This involved the treatment of parts with different shapes and internal passages with different diameters (3, 5, 7.5 and 10 mm). All three surface treatment systems produced surprisingly similar results. Conventional mass finishing and shot blasting consistently removed the roughness peaks and produced similar surface roughness profiles. However, the best results were achieved with chemically supported mass finishing:

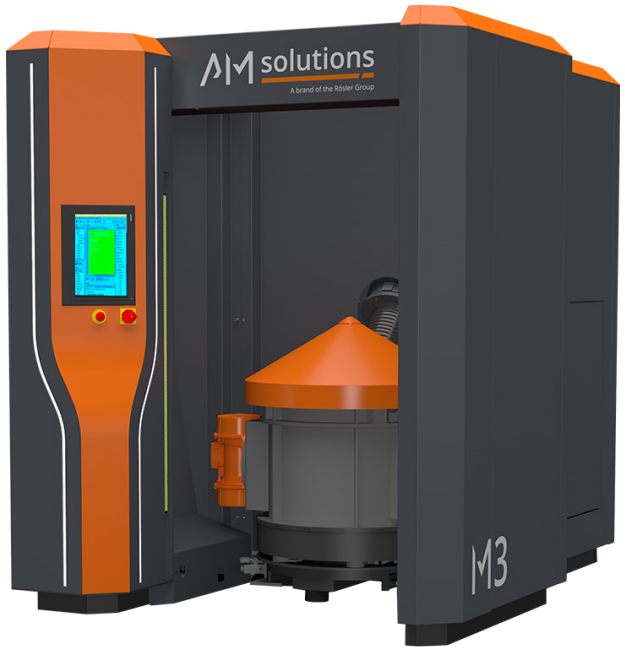
The work pieces had the smoothest surface, as shown in comparatively lower surface roughness readings, and displayed the typical chemically accelerated finish. With Ra values of 0.7 µm the chemically supported mass finishing method produced not only the lowest surface roughness values, but it also required the shortest cycle time. The results also showed that the final roughness values were more or less identical in the vertical and horizontal internal passages. The study also proved that this method can create the required smoothing effect on the internal surface channel areas without affecting the channel geometry. The treated surface areas were free of powder "splatters" and loose powder remnants.



The tests were carried out with different geometries containing internal passages with diameters of 3, 5, 7.5 and 10 mm.

BENEFITS

The study shows that all three treatments methods improved the surface roughness readings on the internal channel areas. However, as already pointed out, chemically supported mass finishing produced the best results in the shortest cycle time. The tests were conducted on a further development of a M3 machine from AM Solutions. The latter is a brand name of the Rösler group that has specialized in the post processing of 3D printed components and offers a range of suitable equipment solutions. These include the complete spectrum of post processing functions like unpacking, removal of support structures, removal of residual powder, surface cleaning and smoothing, edge radiusing, high gloss polishing and surface preparation for subsequent coating of AM components. The further development of the existing M3 system will not only allow the effective and targeted treatment of internal passages in the future, but it will also be a fully automated system for consistent finishing of 3D printed components without any manual work requirements. To date internal work piece passages that are difficult to reach could not be processed at all, or only with a high degree of manual labor. The automated post processing of AM components now allows doing this work within short cycle times at a fraction of the costs and, above all, with consistent, excellent finishing results.



M3 System