Influence of cutting tool geometry on machined surface roughness when machining thin-walled components from Inconel 718 manufactured by WAAM

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This study investigates the influence of cutting tool macrogeometry on the surface roughness of thin-walled Inconel 718 components produced by Wire Arc Additive Manufacturing (WAAM). Several tools with varying geometrical features were tested with the goal of minimizing vibration during machining. However, some tool parameter configurations led to visible marks on the machined surface. Surface roughness was analyzed using focus variation microscopy, evaluating parameters such as Ra, Rz, and Rq to capture key surface characteristics. A comparison was made between the tool that demonstrated the lowest wear and the tool that achieved the best surface finish. The analysis revealed that while certain tool geometries reduced wear, they did not necessarily result in improved surface quality. Additionally, insufficient coolant delivery to the cutting zone was identified as a contributing factor to irregular surface patterns. The findings highlight the importance of carefully selecting tool geometry and optimizing process conditions when machining WAAM-produced thin-walled parts from Inconel 718.

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