End-Mill Carbide Tool Wear in Machining Metallic Biomaterial

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Abstract Machining of metallic biomaterials causes a slew of issues, including cutting tool wear and poor surface quality owing to inefficient tool design, which leads to excessive heat output. The objective of the research is to evaluate the wear of developed of uncoated carbide endmill tool with rake angle varied from positive to negative value in dry machining Stellite 21. The fabricated endmill is tested at Fanuc Robodill α-T14iFb with cutting conditions parameters are kept constant; including cutting speed (Vc): 60 m/min, feed rate (f): 153 mm/rev, and depth of cut (ap): 0.2 mm, throughout the cutting trials. The accuracy of fabricated endmill, wear mechanism, cutting force, and surface roughness were measured using Dino-Lite Microscope, Scanning Electron Microscope, Neo-Momac Dynamometer and Mitutoyo Surface Profiler, respectively. The result shows that by using a positive rake angle, the phenomenon of tool wear is reduced, and directly reducing the surface roughness and cutting force. Based on energy dispersive x-ray (EDX) element analysis, presence of oxygen in the cutting process which indicates the occurrence of oxidation wear on cutting tool. Extended observation of wear mechanism show high content of chromium on the flank face is revealed that indicated the diffusion wear on tools has occurred. In conclusion, the enhancement of tool geometry of endmill cutting tool is a key step toward sustainable manufacturing of high-end applications in biomedical industries.

Keywords End-mill carbide tool · Tool wear · Dry machining · Surface roughness

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M. Y. Ismail et al. (eds.), *Technological Advancement in Mechanical and Automotive Engineering*, Lecture Notes in Mechanical Engineering,
https://doi.org/10.1007/978-981-19-1457-7_59