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Comparative study of cryogenically treated tungsten carbide tool inserts with post treated of annealing & microwave irradiation

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Abstract:

Machining is a versatile technique of producing a wide variety of components from a wide range of materials with acceptable levels of dimensional accuracy and surface integrity. The advances in the field of Materials science and Technology have led to development of new materials with improved engineering properties even for commonly used materials. Even the strength and hardness of a variety of conventional engineering materials has increased many fold to keep pace with development of new materials. Sintered carbides are extensively used as cutting tool material, a material in machining a wide variety of work materials in present day machining industry with proven machining abilities compared to HSS tool and Cast alloy. But in machining of high strength temperature resistance alloys used in aerospace, marine and nuclear applications, they have failed miserably due to rapid wear. This has forced the machining Industry to bring in innovative changes in process design and application in terms of rigid machine tool and new cooling strategies. However, machining of these new classes of materials is still plagued by low productivity due to rapid wear. In the present work, uncoated Tungsten Carbide cutting tool inserts of geometry SNMG 120408-MR4 have been used. The inserts were cryogenically treated and were subjected to annealing in electric muffle furnace by pacing on refractory brick at temperatures 400^{o}C, 600^{o}C, and 800oC. The samples showed appreciable improvement in hardness and microstructure study revealed that carbide phase distribution was fairly uniform with binder phase segregating slightly in few cases. Under all cutting velocities, Cryo-treated and annealed inserts showed the highest tool life and wear resistance. Annealing has significant influence on the phases present in WC+Co inserts and subsequently influences their machining performance.

Keywords:

Machining, Cryogenic Treatment, Tungsten Carbide, Annealing