Micromanufacturing Technology and its Practice

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Abstract

In order to make micro composite drills (Fig. 1), cemented tungsten carbide (WC-10Co) and high strength (AISI 4340) steel were successfully bonded by hot compaction diffusion bonding at a low temperature. The effects of holding time on microstructure and mechanical properties of the sintered carbides and bonding strengths of the bimetallic composites were examined, and a transitional layer was found at the interface as a result of elemental interdiffusion. The optimal bonding parameters were determined to achieve the maximum bonding strength of 204 MPa of the WC-10Co/4340 steel joints, which is helpful in making micro composite drills. Microforming is introduced to produce lighter and more energy effective products. In this study, Magnesium-Lithium (Mg-Li) alloy a new material in microscale, is chosen to superior formed micro-cup due to its ultralight weight with outstanding ductility. The dry and oil lubrication conditions are chosen as benchmarks to investigate effects of water-based nano-lubricant in microforming of Mg-Li alloy. Finite Element (FE) modelling was conducted and the simulated results of rolling forces are in good agreement with the experimental results. The formed cup quality regarding the surface roughness has been extensively evaluated by consideration of various parameters and the quality improvement is substantial.

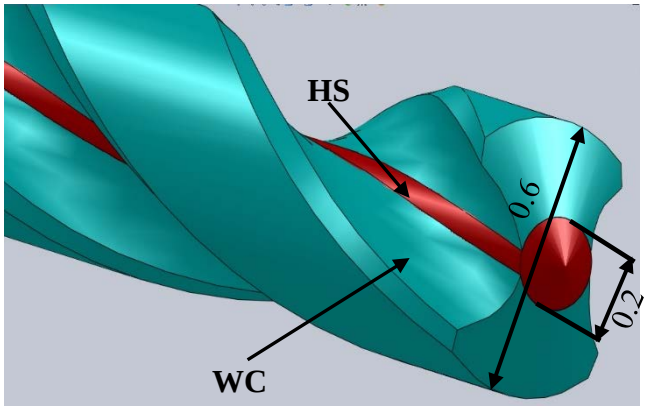

Fig. 1 Micro composite drill