

Achievement of Ductile Regime Machining in High Speed End Milling of Soda Lime Glass by Using Tungsten Carbide Tool Insert

Abstract:

Soda lime glass is widely used in optics, chemical apparatus, camera lens, micro gas turbines, light bulbs etc. on account of its high hardness, corrosion resistance, and excellent optical properties. These require high dimensional accuracy and flawless surface finish. However, soda lime glass is inherently brittle leading to subsurface crack propagation and fracture which compromise its functionality. To avoid these defects, the machining needs to be performed under ductile mode conditions. Therefore, this research investigates the viability and requisite conditions for achieving ductile regime machining (DRM) in high speed micro-end milling of soda lime glass. Machining was performed at high cutting speeds (30,000 to 50,000 rpm), feed rate (5 to 15 mm/min), and depth of cut (3 to 7 μm). A surface profilometer was then used to measure the surface roughness and a scanning electron microscope (SEM) used to scrutinize the resultant machined surfaces. The results demonstrate that ductile streaks and rounded gummy chips (without sharp or jagged edges) are produced in all runs. In addition, there are no subsurface cracks and the minimum surface roughness attained is 0.08 μm . These indicate that DRM of soda lime glass is obtainable using high-speed micro end milling in a conventional end mill with tungsten carbide inserts.