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Effect of Machining Parameters on MRR and Surface Roughness in Internal Grinding using EN8, EN31 Steel

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Abstract
Internal Grinding is an approach to produce desired outcome with greater surface finish in metal cutting process. Unfortunately, external machining parameters play a vital role in research areas with numerous investigations. Considering this, present work focuses on the machining parameters on internal grinding process with necessary coolant oil as has been experimentally observed in our research laboratories. The literature survey predominantly states that the frequently used engineering material in automobile sectors to be EN range of steel and here we have chosen EN8 and EN31. The experimental work was carried out using these two materials in internal grinding machine. The various machining parameters such as cutting force, cutting speed, depth of cut were monitored to analyze the characteristics of outcome such as material removal rate (MRR), surface roughness and tool life. In addition to this, coolant lubrication also constitutes as a main part in improving surface quality and MRR. Surface roughness was measured using SE-1200 surface roughness tester and cutting force was measured using kistler cutting force dynamometer. Comparatively, it could be concluded that the EN31material produces minimum surface roughness 0.628μm in presence of synthetic oil used as cutting oil and also increases the tool life 669.7x10^6 seconds.

Keywords: Internal Grinding; EN8; EN31; Coolant Oil; MRR; Surface Roughness; Tool Life

INTRODUCTION

Grinding is one of the most important metal finishing processes. The abrasive grinding wheel rotates at a high speed to remove the material from the work piece. The materials of the grinding wheels are tempered hardened steel, silicon carbide, aluminum oxide [1, 2]. It is used to improve surface finish and produce close tolerance on flat and cylindrical surfaces by removing a small amount of material [3]. Mostly an abrasive material rubs against the metal part and removes tiny pieces of material. The removal of metal from the work piece is much faster than the one which was earlier done with single edge tools such as chisels. It is also used to sharpen the various cutting edges of cutting tools and sharp objects such as knives etc [4]. The surface roughness and material removal rate were identified as quality attributes and assumed to be directly related to performance of mechanical pieces, productivity and production cost for obtaining a desired machinability. The present article deals with the various input process parameters such as cutting force, Cutting speed and depth of cut, cutting oil [5, 6]. Study on the effect of dissolving a low concentration of TiO_2 nanoparticles in the mineral oil based lubricant, as well as on the overall performance of a window type air-conditioning system using R22 as working fluid was carried out [7, 8]. The nanoparticles that were used to produce nanofluid in the different earlier reviewed articles were Al_2O_3, Cu, copper oxide, gold, silver, silicon and particles and carbon nano tube [9, 10].

Internal grinding is a finishing process used to finish the previously drilled, reamed, or bored hole using small grinding wheels at high RPM. The various elements of an internal grinding machine are the work head used to hold the work and has its own drive and the wheel head, which is the internal grinding spindle. By using internal grinding, several different internal contours can be produced within a work piece [11]. In Internal grinding process, the CBN wheels are used which