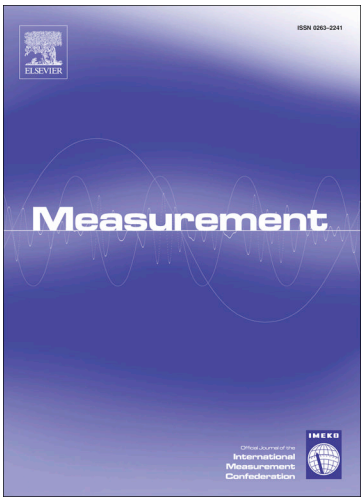

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Investigation on the performance of deep and shallow cryogenic treated tungsten carbide drills in austenitic stainless steel

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Abstract

To increase productivity and reduce production cost, cutting tool performance should be enhanced. When compared with conventional coated tools, cryogenic treatment enhances the life and quality of cutting tools. The mode of cryogenic treatment process affects the tool performance. Therefore, there is a need to reveal the appropriate mode of cryogenic treatment, which fits the requirement, by investigating its effect on the cutting tool performance. In this investigation, the performance of deep and shallow cryo-treated tungsten carbide drills has been evaluated and optimized based on minimum of : maximum thrust force, average surface roughness, circularity error and exit burr height while drilling 304 grade austenitic stainless steel which is a hard-to-machine material and widely used in industries. The significant contribution of this investigation is stating that shallow cryo-treated WC twist drills will be more economical for making small series of holes without compromising the hole quality whereas deep cryo-treated drills will be more suitable for making long series of holes.

Keywords: Austenitic stainless steel; Deep cryogenic treatment; Shallow cryogenic treatment; Tempering; Drilling; Surface roughness; Ovality; Burr; RSM

1. Introduction

The overall cost of the machining process relies mainly on the tool life and its performance. Therefore, most of the industries uses tungsten carbide (WC) as a cutting tool because of its superior performance than its counterpart high speed steel (HSS). The life of WC tools is being enhanced either by applying coatings or by adding alloying elements. The manufacturing industry appreciates enhanced tool life as an important economic factor. The