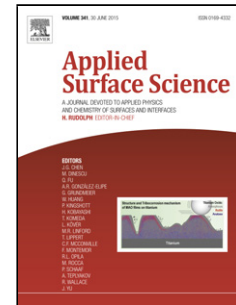


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Surface quality and topographic inspection of variable compliance part after precise turning

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Highlights

- surface topography analysis of variable compliance part after precise turning
- evaluation of turning dynamics based on PSD of force and surface topography
- analysis of factors affecting surface profile with surface roughness ratio
- influential effect of cutting speed on surface quality of variable compliance part

Summary

The paper presents the problem of precise turning of the mould parts with variable compliance and demonstrates a topographic inspection of the machined surface quality. The study was conducted for the cutting tools made of cemented carbide with coatings, in a range of variable cutting parameters. The long shaft with special axial hole, made of hardened 55NiCrMoV6 steel was selected as a workpiece. The carried out study included the stiffness measurement of the machining system, as well as the investigation of cutting force components. In this context, the surface topography parameters were evaluated using the stylus profile meter and analysed. The research revealed that the surface topography, alongside the 3D functional parameters, and PSD influences the performance of the machined surface. The lowest surface roughness parameters values, equalled to $Sa = 1 \mu\text{m}$ and $Sz = 4.3 \mu\text{m}$ have been obtained during turning with cutting speed $v_c = 90 \text{ m/min}$. The stable turning of variable compliance part affects the surface texture formation with a unidirectional perpendicular, anisotropic structure. Nevertheless, in case of unstable turning, the characteristic chatter marks are observed, and process dynamics has greater contribution in formation of surface finish than turning kinematics and elastic plastic deformation of workpiece.

Key words

surface metrology; surface topography; precision manufacturing; hardened steel; injection moulds; dynamics

1. Introduction

The workpiece rigidity in cutting processes reflects the machined surface quality [1]. The control and evaluation of the machined parts quality is important in cost analysis for creating precision surfaces [2]. The manufacturing of moulds parts made of hardened steel – especially

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