A REVIEW IN SURFACE INTEGRITY IN HIGH SPEED MACHINING OF HARDENED STEEL

Balan Cristina- Iuliana[1]

[1]*Faculty of Mechanical Engineering, Mechatronics and Management, "Stefan cel Mare" University of Suceava, cristinaiuliana.balan1988@gmail.com*

Abstract: *Steel parts, generally, have to be machined after heat treatment, in order to obtain both the correct shape and the desired surface finish. However, during the past few years, high speed machining (HSM) has emerged as an effective method for increasing efficiency, quality and accuracy of the machined surface, and also to reduce costs and machining time. The present paper provides an overview of high speed machining induced surface integrity in hardened steels. There are many types of surface integrity (SI) problems reported in literature, among those being surface roughness, residual stresses, white layer and work hardening layers, as well as microstructural alterations. From the multitude of parameters influencing the SI of a machined surface, cutting conditions, cutting tool characteristics, workpiece material properties and machine tool rigidity appear to be the most significant.*

Keywords: *surface integrity, high speed machining, hardened steel*

1. Introduction

High speed machining (HSM) is a recent technology that has grown rapidly during the past few years in industries manufacturing aerospace, automotive, defense and missile components. In broad terms, HSM can be defined as a material removal process with cutting speeds that, for a certain material, are two to five times higher than the conventional ones, used for the same material [1].

In reality, it should be noted that HSM is not only high cutting speed. Thus, according to [2] there are many other ways to define this concept, as it follows:

- high rotational speed machining;
- high feed machining;
- high speed and feed machining;
- high productive machining.

The major benefit of high speed machining is the reduction of cutting forces, which leads to improvement in surface integrity, in terms of lower cutting force magnitude, finer surface finish and a lower depth of deformation in the machined subsurface. HSM of tool steels in their hardened state decreases the machining costs, compared with the traditional manufacturing method where the workpiece is first machined in its annealed state, followed by hardening, grinding/ EDM (Electrical Discharge Machining), and, finally, hand finished. Usually, this manufacturing technology results in a very good surface finish, the need for final finishing operations being diminished.

Surface integrity (SI) of a machined component represents the critical parameter that decides its performance, reliability and service life. In literature, the SI is defined by two aspects: *surface topography characteristics*, comprised of roughness, waviness, form errors and flaws, and *subsurface layer characteristics*, which can change due to machining processes and that include plastic deformation, residual stresses, cracks, hardness, overaging, phase changes, phase changes, recrystallization and intergranular attack. These characteristics are influenced by a large number of factors: cutting parameters (speed, feed, depth of cut), cutting tool geometry and material properties,