



## THE EFFECTS OF SHOT PEENING ON THE FATIGUE LIFE OF MACHINE ELEMENTS

**Dragan ADAMOVIĆ, Milentije STEFANOVIĆ, Branislav JEREMIĆ, Srbslav ALEKSANDROVIĆ**  
Faculty of Mechanical Engineering in Kragujevac, S. Janjic 6, 34000 Kragujevac, Serbia  
[adam@kg.ac.rs](mailto:adam@kg.ac.rs), [stefan@kg.ac.rs](mailto:stefan@kg.ac.rs), [bane@kg.ac.rs](mailto:bane@kg.ac.rs), [srba@kg.ac.rs](mailto:srba@kg.ac.rs)

**Abstract:** For increasing the resistance to fatigue and wear, different methods for improvement of contact layers properties are used. First of all, the improvement of properties is realized by heat treatment (induction and flame hardening), chemical-heat treatment (carburizing and nitriding) and plastic surface forming (surface forming by rolls, disks and balls, as well as shot-peening). The paper gives detailed explanation of the shot peening procedure, which involves the ejection of shots at high speed onto the forming object. The intensity of impact is the function of the kinetic energy and angle at which the shot hits the forming object. Thereat, smaller or larger increase of hardness occurs on surface layers, remaining stresses are made, surface topography is changed, and, in some cases, the structural changes are possible (disintegration of remaining austenite). This all leads to increase of fatigue life of elements subjected to shot-peening. The influence of specified effects on the increase of fatigue life depends on strength of material subjected to shot-peening but also on conditions at which the shot-peening process is performed. This paper will present the influence of shot peening on the increase of fatigue life of different parts.

**Key words:** Shot Peening, Fatigue Life, Machine Elements

### 1. INTRODUCTION

The shot-peening process involves the ejection of shots at high speed onto the forming object. Each shot which hits the object seems like the blow of a tiny hammer. The intensity of impact is the function of the kinetic energy and angle at which the shot hits the forming object. Thereat, smaller or larger increase of hardness occurs on surface layers, residual stresses are made, surface topography is changed, and, in some cases, the structural changes are possible (disintegration of residual austenite). This all leads to increase of dynamic strength of elements subjected to shot-peening. The influence of specified effects on the increase of dynamic strength depends on strength of material subjected to shot-peening, but also on conditions at which the shot-peening process is performed.

Unlike shot blasting, which is used for cleaning surface of parts by tiny sand particles, shoot-peening is used for strengthening part surface. It is performed with small hard balls, which can be made of steel, cast iron, glass or ceramics.

### 2. THE INFLUENCE OF SHOT-PEENING EFFECTS ON DYNAMIC STRENGTH

It is well known that forming by spray of balls can improve fatigue of metal materials. That improvement is reflected in one of the two possible ways: increase of stress for constant life or increase of life for constant stress, as shown in figure 1 [1]. However, it is also possible to reduce part mass for the same loading and life,

which can be extremely important, especially in airline, car and military industry.

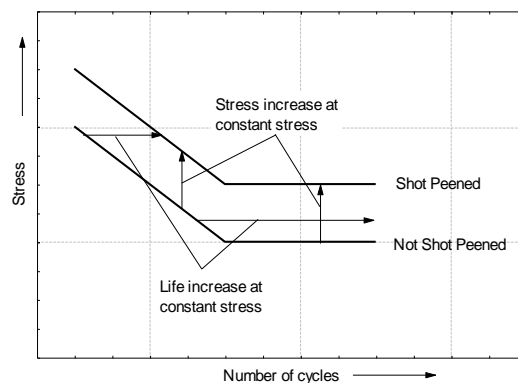


Fig.1. Influence of shot peening on material fatigue behavior

Hardening by shot peening can be done by variation of many parameters, enumerated in the first column in Figure 2, [2], which represents conditions in which the peening process is done.

The shot stream affects the condition of surface layers or the working piece. In certain cases the following changes can occur:

- breaking or removing of the protective layers, e.g., oxide layers,
- change of the surface topography  $\Delta R_t$ ,
- hardening or softening of surface layers, represented as changes in hardness  $\Delta HV$ ,
- changes of the residual stresses  $\Delta \sigma^{RS}$  in layers close to the surface, due to creation of certain distribution





