Shot Peening Machine

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Abstract- *Shot peening is a surface treatment widely used to improve the fatigue performance of automotive and aerospace components. Beneficial compressive surface residual stress are introduced by projecting small, hard particles at high velocity onto a metallic part to plastically deform the surface. Shot types follow standardized size ranges and, in typical treatments, non-uniform impact velocities may also be encountered. In the current work, shot size and impact velocity distributions were evaluated and modelled for a specific industrial peening treatment with a sparse shot stream, using experimental data on shot and impact dimple sizes combined with finite element modelling and Monte Carlo simulations. The potential influence of impact velocity variability was assessed in terms of the residual stress state and surface roughness. For the process under study, depth of compressive residual stress was found to increase by 10% when accounting for non-uniform velocities, while the maximum compressive residual stress did not vary significantly. Furthermore, the advantages and limitations of omitting the lower-energy impacts to reduce the computational cost were evaluated.*

Keywords- Finite element,Process variability,Residual stress,Shot peening

I. INTRODUCTION

Shot peening is a surface treatment commonly used to improve the fatigue performance of metallic components in the transportation, medical and energy industries. During the process, a large number of small and hard particles, called shots, are projected at high velocity onto a ductile surface. Each shot impact plastically deforms the material in its vicinity. Repeated impacts create a permanently deformed layer and tend to stretch the surface. Owing to the plastic strain gradient, the underlying material opposes this surface stretching, which results in beneficial in-plane compressive residual stresses at the surface.

In industrial applications, shot peening is controlled for quality through the so-called Almen intensity and coverage. The Almen intensity of a given treatment is determined with a test in which multiple standardized SAE 1070 steel strips are peened for different exposure times. The arc height of each strip is then mea-sured using a dedicated instrument, an Almen gauge, and plotted against its exposure time. A treatment's Almen intensity is defined as the arc height at saturation, expressed in millimeters or thousandths of an inch, for which doubling the exposure duration increases the arc height by 10%.

II. LITERATURE REVIEW

George Leghorn,(November 1957) [1] presented that shot peening is a means of cold working the surface of metal parts by means of a hail or blast of round metal shot directed against the surface. It is equivalent to a myriad of small hammer blows impinged over the entire surface indenting the surface and causing plastic flow and work hardening of the surface metal. This work hardening of the surface metal increases its tensile strength and yield point.

THEORY OF SHOT PEENING:-

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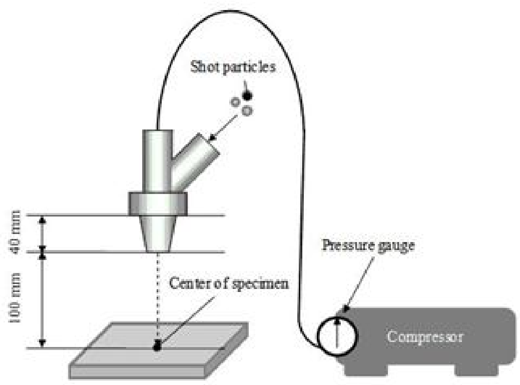

FIG:- PROCESS OF SHOT PEENING

There are numerous applications where the compressive stress produced by peening, which can be as much as half the yield strength of the material, is of size and condition of the peening media, the time the workpiece is exposed to the blast stream.

The size and configuration of the nozzles, angles, distances and other related factors it is possible to control accurately the depth of the compressed layer, the distribution o f stress and in consequence, the greater life expectation of the workpiece. If copper is hammered too much, it can become brittle and subject to cracking; however, it takes a lot of hammering to do this. It does show, none the less, that the armorer had to use experienced judgment in forming a spear head from a rough block of copper, First, he had to fire treat it (anneal) to make it soft and ductile and receptive to hammer forming. He next hammered it to rough form and then reannealed it to remove the hammer hardness prior to the final hammering of the spear point to its desired shape and strength.

Knowing just how far he should carry his first hammer forming and annealing so that final shaping by hammer would give the weapon excellent hardness and strength without brittleness, called for a lot of experience and judgment on the part of the armored. If copper is hammered too much, it can become brittle and subject to cracking; however, it takes a lot of hammering to do this. It does show, none the less, that the armorer had to use experienced judgment in forming a spear head from a rough block of copper, First, he had to fire treat it (anneal) to make it soft and ductile and receptive to hammer forming.

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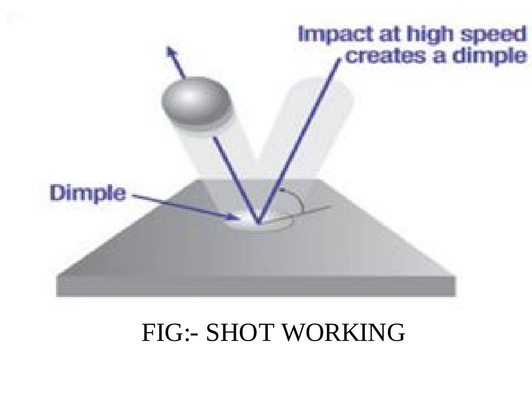

FIG:- SHOT WORKING

The modifications of the surface chemical activation, as well the multiplication of diffusion short-circuits in the strongly affected superficial layers of the material, are believed to be the main factors promoting the formation of this nitrogen.

III. CONCLUSION

In this work we have studied the effect of SP treatments on the high temperature oxidation behavior of pure titanium. Several types of balls were used in order to study influence of the nature of the balls: WC, Al2O3 and glass balls. The latter ones was used only for stripping purposes on samples already shot-penned with WC balls. Isothermal tests in a thermo gravimetric In the same oxidation conditions, the samples treated with Al2O3 balls give even more purposes), the best oxidation results were obtained for the shot-peened and stripped samples. All the other samples showed breakaway and spallation after about 1700 h of oxidation, giving results comparable with the untreated samples.

Impressive mass gains reductions of about 75%. For long oxidation tests (3000 h at 700 °C, with periodic cooling stages for weighting.

REFERENCES

[1] Byrne, J. and Burgess, A., Surface improvement for structural integrity and life extension. 8as Jornadas de Fractura, UTAD, Vila Real de Trás os Montes, Portugal, (2002) Ed. by SPM.
[2] SPM, Shot peening. Course about structural failure and cases study "Curso Sobre Ruína de Sistemas eEstudo de Casos" (2001), SPM. . Li J.K., Yao, M., Wang, D. and Wang, R., Fatigue and Fracture of Eng. Mat. and Structures 15 (1992) 1271.
[3] Methods And Models For Shot Peening Simulation Mats Werke Swerea IVF, Molndal, Sweden.
[4] “Shot Peening Overview Jack Champaigne Electronics Inc 1428 W. 6TH Street Mishawaka, In 46544.
[5] George Leghorn “The story of shot peening” A.S.N.E. Journal November 1957, pp 653- 666.