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Shot blasting highly polished surface for enhanced nitriding operation

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This research presents an innovative shot-blasting technology that maintains the surface conditions of a highly polished, mirror-finished surface, within nanometric precision and yet imparts a beneficial layer for an enhanced nitriding operation. The shot-blasting media is composed of an elastic polymer core (0.5 mm) coated with a 1 μm thick hard diamond material. The media particles are propelled to obtain a high kinetic energy and strike the target. This generates high pressure on the surface, which propagates into the subsurface producing a layer of refined grain-size with an increased dislocation density. The characteristics of metals to deform plastically depend on the ability of dislocations to move and the existence of actual barriers to slip. Therefore, the refined grains and increased dislocation density give way to a strengthened layer. In this experiment, the kinetic energy of the media is varied by changing the speed and type of media materials. The effect of the kinetic energy on the diffusion rate of nitrogen atoms and eventually the nitriding time required to attain a hardened layer is evaluated. Here, Electron Beam Excited Plasma (EBEP) was used to nitride SKD 61 tool steel. The nitriding treatment was performed for 3 hours at 500 oC. The underlying influence of shot blasting pre-treatment on nitriding operation was observed based on the micro-hardness test, corrosion test and surface roughness measurement.

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