

## Experiment On The Effect Of A Plasma Stream In Nitrogen Gas On The Surface Hardness Property Of Steel

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### ABSTRACT

A 3.3 kJ dense plasma focus device was used to modify the surface of the AISI 1020 steel substrate or better known as low carbon steel to improve its properties. There are weaknesses in the properties of the steel such as low hardness value and inferior wear. The method chosen in this experiment would be to use Mather type-Plasma Focus device. In this experiment, ion assisted plasma beam works together with filling gas of nitrogen to change the surface hardness by nitriding process. The objectives will be to synthesize nitride layer on the low carbon steel. The designs involving the machine parts have been presented. The material would have the mirror polished surfaces. Optimum pressure was calculated by using the Lee code. The gas pressures were varied in order to get the correct current dip. The chosen working pressure would be 1 Torr of Nitrogen gas. The experiment was carried out by fixing the height of substrate 40 mm from the anode and the number of shot will be varied from 10 and 30 shots. Three samples were used in the experiment. Sample 0 was the untreated steel which gives the standard values for any test, Sample 1 was tested with 10 shots, and Sample 2 was tested with 30 shots. Sample 1 has more micro cracks, bubbles, and voids also a bulb like structure on the surfaces as when tested in the SEM. Together with that the nitrogen element on the steel was not evenly distributed when it was tested in EDX. Thickness achieved was approximately 100.25  $\mu\text{m}$ . The hardness value at 10gm will be 772.4 Hv. Sample 2 has better and uniform surfaces. More definite pattern could be observed on the surfaces. Less bubbles and there was no micro cracks occurs. The nitrogen element was evenly distributed among the surfaces. Thickness achieved was approximately 124.6  $\mu\text{m}$ . The hardness value at 10gm will be 839.5 Hv. The numerical fittings were done to compute the plasma densities by using the waveform recorded by the Rogowskii coil. As to conclude, the Sample 2 was chosen to have the better parameter because of the uniform surface morphology, even gas distribution and highest number of hardness if to be compared with the Sample 1 or even Sample 0.