Effect of Pulse Repetition on Pulsed Plasma Nitriding of AISI 4340 steel and its Fatigue Crack Growth (FCG) and Polarization studies

Arul Varman\textsuperscript{1}, Balasubramanian M\textsuperscript{1}, Uwe Huchel\textsuperscript{2}

\textsuperscript{1}Indian Institute of Technology - Madras, Chennai, India \textsuperscript{2}ELTROPULS, GmbH, Germany

arul_amv@yahoo.com

D.C. Pulsed Plasma Nitriding (PPN) was carried out on AISI 4340 hardened and tempered steel, and the effect of pulse repetition on compound layer properties were studied. In general, the plasma nitriding surface hardening process has been widely used in automotive industries because of its high process robustness and eco friendly nature. Also, the process parameters can be easily tailored for the intended applications.

In this PPN research work, the pulse repetition was ranged from 0 millisec to 500 millisec with an interval of 100 millisec while the pulse duration was kept as constant (50 millisec). The nitriding temperature and gas ratio (H2:N2) was fixed to be 540°C and 1:3 respectively. The surface hardness and case depth measurements were done by Micro Vickers hardness tester. SEM was done to find out the microstructure and the denseness of the compound layer formation. XRD analysis was carried out to find the structural changes (crystalline phases) in the compound layer, and also for residual stress measurements. In addition, Fatigue Crack Growth (FCG) and Polarization studies were carried out on plasma nitrided and untreated samples to find out the fracture limit and corrosion potential values, and its relationship were discussed in detail.

Keywords
Plasma Nitriding
Pulse interval
FCG
Characterization