1.0 - Comparative Study – Conventional Nitriding VS. Plasma (ion) Nitriding		
Conventional gas Nitriding/Carburising/Oxidation	**Plasma (ion) Nitriding/Nitrocarburising/Oxidation**	**Overall benefits (Plasma (ion) Nitriding)**
High temperature process	Low temperature process	• Low distortion rate • Minimised reject quantity • Single, automated process for improved traceability • Reduced project costs • Reduced rejection rate • Furnace batch treatment • Increased MOQ • Reduced lead time • **Additional plasma assisted sub-processes to rival Oxidation and and Carburising are also applicable for added corrosion or wear resistance**
Parts undergo phase transformation (BCC – FCC) or (Ferrite to Martensite) causing retained Austenite in-turn requiring additional processes to even out grain structure i.e. (Sub Zero requirement)	No phase transformation	
Often performed on semi-finished parts due to concerns for distortion control	Performed on machined finished parts immediately ready for production run	
Uneven gas distribution during treatment causing irregular surface treatment outcomes increasing reject %	Plasma glow discharge envelopes the entire work piece contributing to superiorly uniform surface treatment	
Standard batch run practices	Programmable and automated treatment cycle	
Varied results	Highly repeatable results	
Past technology	Contemporary wear and corrosion characteristics	

2.0 – Description: Plasma-assisted ferritic nitriding.

Plasma-assisted ferritic nitriding is also known as **ion nitriding**, **plasma ion nitriding** or **glow-discharge nitriding**. The process works to achieve the same result as the salt bath and gaseous process, except the reactivity of the media is not due to the temperature but to the gas ionized state.[1][2][3][4] In this technique intense electric fields are used to generate ionized molecules of the gas around the surface to diffuse the nitrogen and carbon into the work piece. Such highly active gas with ionized molecules is called plasma, naming the technique. The gas used for plasma nitriding is usually pure nitrogen, since no spontaneous decomposition is needed (as is the case of gaseous ferritic nitrocarburizing with ammonia). Due to the relatively low temperature range (420 °C (788 °F) to 580 °C (1,076 °F)) generally applied during plasma-assisted ferritic nitrocarburizing and gentle cooling in the furnace, the distortion of work pieces can be minimized. Stainless steel work pieces can be processed at moderate temperatures (like 420 °C (788 °F)) without the formation of chromium nitride precipitates and hence maintaining their corrosion resistance properties.

3.0 - Process Flow – Plasma Nitrocarburising

- Ferritic stage stainless steel grade workpiece grinding to finished tolerance of -µ
- Workpieces are evenly placed on furnace base plate and/or jigging
- Furnace chamber is evacuated to a ‘low vacuum’ atmosphere
- Positively charged work piece
- Ionised gasses introduced into furnace chamber
- Induced current causing abnormal glow discharge (Fig. 1) to be achieved
- Bombardment of ionized gas molecules onto substrate – to +
- Controlled gas flow & current
- Gradual heat-up due to bombardment
- Nitrogen molecules penetrate substrate
- Nitrides are formed
- Gradual cool-down

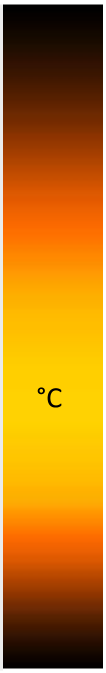
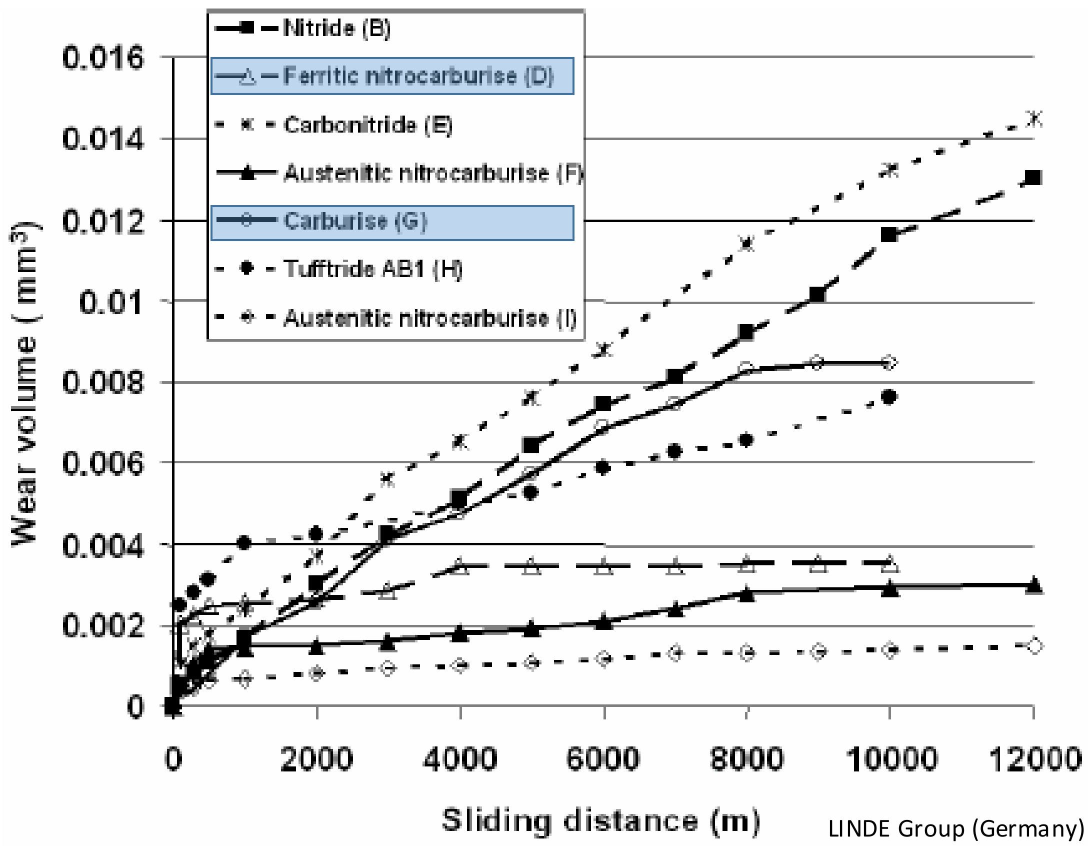



Fig. 1

4.0 Comparative Study – Wear comparison chart (Carburising VS. Ferritic Nitrocarburising)



LINDE Group (Germany)

The above graph details a significant improvement in wear resistance from conventional gas treatments as compared to Integral Heat's treatment service of Plasma (ion) Nitriding.

For enquiries, kindly contact our hotline at **6883 9051** or email us at enquiry@integralheat.com

References:

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2. *Jump up ^ An Introduction to Nitriding p. 9*
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