Study of aisi304 and silicon surface treated by piii batch processing using hv blumlein pulser with pulse extended to the microsecond range

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PIII batch processing process is an important technique used to optimize the properties of metallic and semiconductors surfaces for industrial applications such as components used in the aerospace industry with strict standards. To perform PIII processing a high voltage 100 kV/1µs stacked Blumlein pulse was used initialy. A longer pulse duration during the PIII process increases the duty cycle and the higher voltage of pulses permits deeper penetration of ions into the materials without dependence to the thermal diffusion. For this, a redesign of the Blumlein pulser was made for changing the output voltage from 100 kV (nominal) to less than 30 kV but increasing the pulse duration from 1.0 µs to 5.0 µs. To obtain a modified HV Blumlein pulser of lower voltage but longer pulse duration, the five-stage stacked device has been converted to one-stage, using the same 10 coaxial lines (100 m each) and the initial pulser structure support. Thus, each extended line of the one-stage Blumlein device in this configuration has 500 m length (i.e. 5 cable of 100 m in series) with 10 ns/m of double delay time, reaching pulse duration of the order of 5 µs. To reduce the corona effect, the frequencies of the operation are limited to 100 Hz. In this way, this new PIII system has allowed the treatment of multiple and bigger samples or workpieces in a batch-mode. This new configuration allows us to using this system for several different materials such as stainless steel that require treatment with pulse duration above 1µs. The treated samples by PIII using this new system will be analyzed by x –ray diffraction (XRD) to confirm the success of nitrogen implantation, by ball-on-disk to verify the enhancement of friction coefficient and by potentiostatic corrosion test to check corrosion resistance changes. Silicon samples are also treated for analysis by high resolution XRD.