

Heat Treatment of Surface Martensite in Spring Wire Manufacturing

Plasmait GmbH, an Austrian supplier of heat and surface treatment machinery has introduced a new heat treatment machine to deal with surface Martensite on steel wire.

Wire shaving is commonly used by spring manufacturers to achieve scale-free surface with as little contamination as possible. Steel wire shaving usually results in surface martensite. An example of this is shaving of valve spring wire.

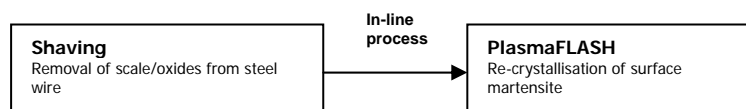
Martensite is an undesired crystal form of steel that makes further drawing impossible. In a traditional process martensitic surface is first heat treated in a patenting line. The wire is then taken to a batch pickling process for further acid cleaning (see the diagram below).

Traditional Process for Surface Martensite Treatment in Spring Wire Manufacturing:



To streamline the traditional process Plasmait developed the PlasmaFLASH process that transforms (re-crystallises) the martensitic crystal structure into austenitic crystal form. The process is conducted in a controlled atmosphere. The atmosphere can be inert if surface oxidation is not required. Oxygen can be added to the plasma process if surface oxidation is desired. PlasmaFLASH operates at the speed of shaving line and is therefore installed inline with the shaving line.

PlasmaFLASH Process for Surface Martensite Treatment in Spring Wire Manufacturing:



PlasmaFLASH was installed in a valve spring manufacturing line. The line produced 6 mm valve spring wire at 1.5 metres per second. PlasmaFLASH was placed in-line with the shaving process (see the diagram). PlasmaFLASH was installed as a replacement for patenting and batch acid pickling.

PlasmaFLASH is a small compact machine that operates inline with the shaving line (see picture below). The PlasmaFLASH process is adjusted to induce a sufficient amount of heat into the wire surface in order to initiate re-crystallisation of the surface martensite. The power input per square mm of wire surface will depend on the surface martensite thickness. For example, approximately 8 kW of power is used to re-crystallise a 15 micron thick layer of martensite on a 6 mm steel wire running at 1.5 metre per second. The heat used for re-crystallisation is then conducted into the body of the wire, which increases in temperature by about 40 degrees Celsius. The process is performed in a controlled atmosphere preventing the surface to oxidise. If surface

oxidation is required, PlasmaFLASH can be set up to allow for the oxidation to occur during the process. PlasmaFLASH is available for wire diameters between 4mm and 10mm.

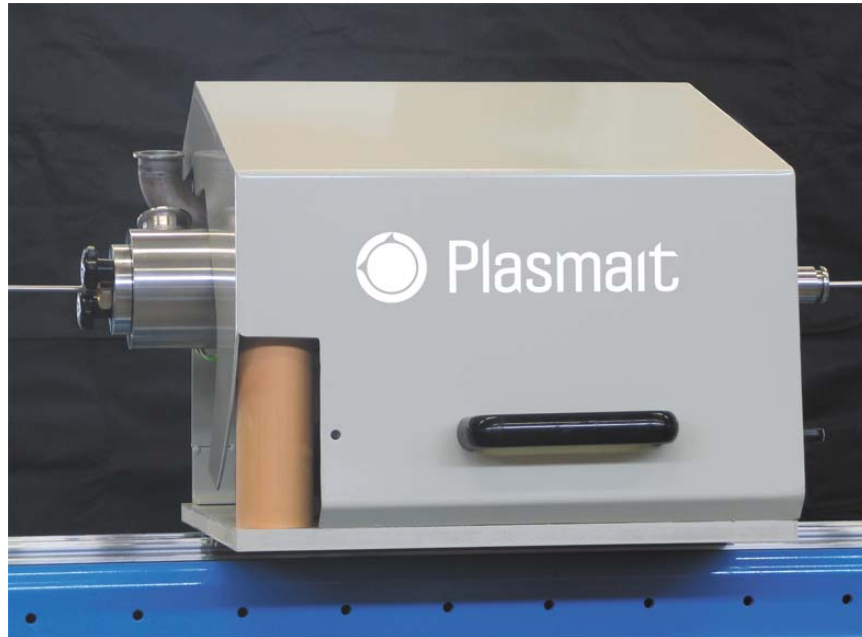


Figure 1. PlasmaFLASH Machine for Treatment of Surface Martensite.

PlasmaFLASH machine demonstrated to offer a simple and cost effective alternative to patenting in treatment of surface martensite. Most importantly, PlasmaFLASH operates in-line with the shaving process, which reduces the manipulation costs. The process results in only marginal increase in temperature of the wire, which reduces the cost of cooling. The machine is small and compact and can be fitted as an add on to the shaving machine. The PlasmaFLASH process runs at about 90% energy efficiency. The maintenance costs are low compared to the maintenance costs of the traditional patenting line. The degree of surface oxidation of the spring wire can be manipulated with the choice of process atmosphere.

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