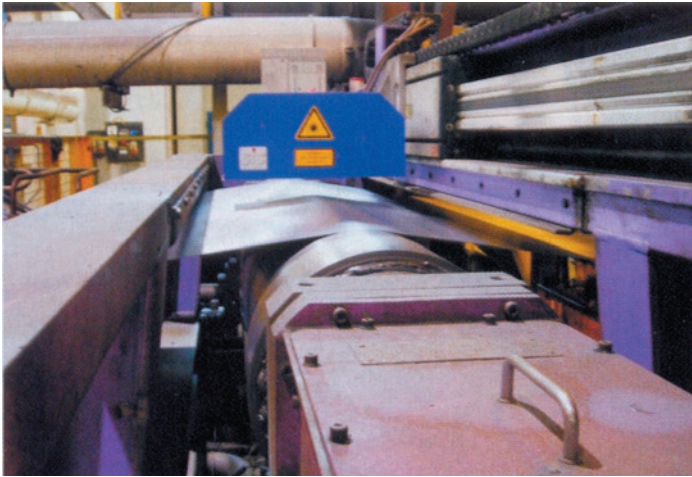


Online measurement of the surface roughness of steel strip

Quality can be planned

'A belt and braces quality check', this would be a good description of the quality assurance system at voestalpine Stahl GmbH in Linz. In addition to the conventional method of measuring the surface roughness of steel strip using a stylus, the Austrian company also uses a new device, which allows on-line measurement without contact with the moving steel strip.



Online measuring equipment EMG-SORM 3plus (blue device) on the continuous annealing line
Location: immediately downstream of the skin-pass mill

'We have a well-balanced customer structure and we conduct our business mainly on the basis of long-term contracts', comments Werner Schwarz, process manager of annealing, skin-pass rolling and texturing in the cold-rolled strip/processing unit of the company, on the positive business development at voestalpine Stahl. In the financial year 2002/2003 (ending on March 31, 2003), the Steel Division of voestalpine AG generated sales of 2,188.5 million Euro with a staff of about 9,300. voestalpine Stahl GmbH being the lead company of the Steel Division achieved during the same period a turnover of 1,544.7 million Euro with a staff of 6,300. This company concentrates on the

development, production, processing and sale of superior steel products such as hot-rolled strip, cold-rolled strip, strip protected by hot-dip or electrolytic galvanizing or by organic coating and electrical steel strip. Our strength is the wide variety of products and materials which includes deep drawing and special deep drawing qualities made from extremely low-carbon, vacuum-treated steels as well as deep-drawing and drawing qualities made from aluminium-killed steels up to super high strength steels.'

The major accounts of voestalpine Stahl GmbH are the automotive industry – where voestalpine ranks amongst the top suppliers – the household appliances industry (market share 20 %) and the construction industry (market share 25 %).

Ambitious goals for the future

'We want to become one of the leading European centres in expertise for steel for the automotive industry', explains Werner Schwarz. However, it is a fact that the quality

requirements on sub-suppliers' products are extremely high. 'To meet increased demands from customers, the automotive industry has clearly defined ideas on the surface quality of our products. Surface roughness is a crucial factor, especially in the case of cold-rolled products for car bodies. It is critical for the forming behaviour and in connection with the peak value, i.e. the maximum distribution per centimetre, and with the topography, it has a considerable influence on the lacquer appearance of car bodies, says Schwarz.

Sampling has greatly increased

Leopold Baa, who since 1988 has been responsible for the "cold-rolled strip and strip coating" testing laboratory, confirms the tendency for a constantly higher product quality: 'The demands of the automotive industry with respect to consistency and uniformity of the surface quality have increased especially since the eighties, which has led to a continuous increase in the frequency of sampling for product testing.' Besides the product parameter of surface roughness, the peak value has gained importance as another major quality feature of steel strip at the same time.

Unjustifiable throughput times

'In former times, surface roughness measuring was carried out for various divisions along with tensile testing by the voestalpine central laboratory, in the sense of 100% product testing. Depending on the specification, a maximum of three samples was taken from a coil (leading end, middle, trailing end). The test results were only available after quite some time, in extreme cases only after eight hours.

Testing in situ

'This situation was unsustainable for us, particularly as advanced and rapid production lines, like our continuous annealing line put into operation in 1998, which enables production of a coil with an average weight of 25 tons in just 15 minutes, call for much faster testing procedures, in order to guarantee continuous product quality without any disruption', explains Schwarz.

'We have made the best of it and developed and implemented the fully automatic inline testing station CATS (Continuous Annealing Testing Station) for measuring surface roughness on the production line', says Werner Schwarz. This device, which was developed in-house, is stationed at the exit area of the continuous

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Gerald Hinteramskogler, responsible for the project
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„Annealing and skin-pass rolling“
Leopold Baa, responsible for the “cold-rolled strip and strip coating” testing laboratory

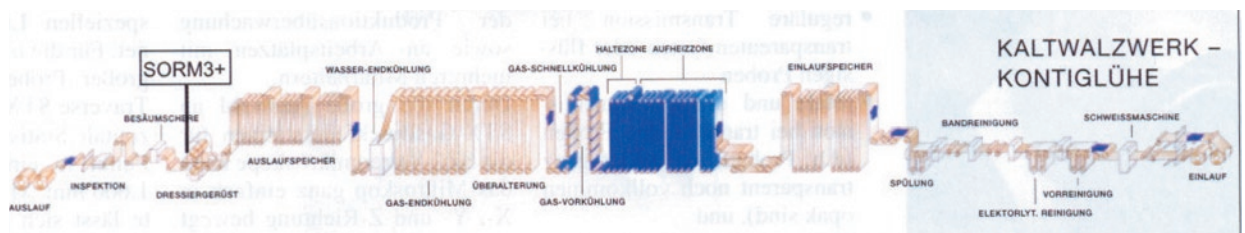
annealing line (since 2003 it is also installed on hot-dip galvanizing line no. 3). It automatically measures the surface roughness and the peak value on the upper and the lower side of the samples at three positions across the width of the coil.

Using CATS, voestalpine Stahl GmbH have been able to reduce the time for measuring the surface roughness to 10 - 15 minutes.

Quickly is not always quickly enough

This was an impressive result which could well have satisfied Werner Schwarz – but he was still not content. ‘I wanted to have the test results immediately, without any delay, and any measuring method would have been all right. The only condition was that the values had to be reliable and comparable by

Schematic of the cold-rolling mill continuous annealing line at voestalpine Stahl GmbH



correlation with the values determined using the recognised stylus testing method.’

In search of a practicable method, voestalpine Stahl finally found the solution in the neighbouring country, Germany.

Predestined for high-speed production lines

An innovation of EMG Elektro Mechanik GmbH in Wenden, Germany, an enterprise of the elexis group, is EMG-Sorm 3plus. This device is used for the optical roughness measurement of moving strips and enables the non-contact online measurement of the surface roughness of cold rolled steel strip. As opposed to conventional surface roughness

measurement using a stylus, the strip must not be stopped. Since the testing equipment provides reliable measured data at production speeds of up to 2400 m/min it is predestined for high-speed production lines.

Results are available in a few seconds

Since November 2003, EMG-SORM 3plus has been in operation on the continuous annealing line of voestalpine, immediately downstream of the skin-pass mill where roughness is created on the strip surface. Gerald Hinteramskogler, who is a specialist in the field of testing technology at voestalpine Stahl says: ‘If we checked the strip manually following skin-passing, the strip would have to be stopped and undesirable downtimes of the production

line would be the result. Furthermore, the time required for actually checking the strip should not be underestimated. This is not done in a jiffy.’ The situation is quite different when EMG-SORM 3plus is used: Determination of surface roughness and of the peak value over the full strip length is carried out and transmitted to the central control room of the line within a few seconds.

Surface roughness measurement using a stylus will remain indispensable

Although Werner Schwarz’s wish for immediately available data has come about with EMG-SORM 3plus, he cannot and will not dispense with conventional measurement

of the surface roughness using a stylus, and this is for a good reason: ‘All parameters and all values specified by the customer with respect to roughness and peak value are based on the method using a stylus, and this method is very well established for measuring the surface roughness of steel strip. We cannot do without this technique, as it is well-known to our customers. They require this method and apply it themselves’, says Schwarz. He is convinced that this process will be retained at least in the near future.

Online measurement as a means of control

With this background, does the use of EMG-SORM 3plus make sense?

‘We use this equipment as an instrument for process control. At the exit of the continuous annealing line, we carry out 18 measurements on the upper and lower surfaces of each sample using CATS. With manual operation, this would not be possible during the time in which the coil is produced. EMG-SORM 3plus provides for each coil up to 200 additional measured results. Based on our customers’ requirements, the majority of the measured surface roughness values are between 0.5 and 3µm and the peak value is between 60 and 100 peaks/cm. This volume of data gives us an extremely high level of data reliability with respect to the quality of the steel strip produced. Furthermore, online measurement

using EMG-SORM 3plus allows us even more optimum operation of our production lines’, states Schwarz.

The line operator cannot only influence the produced surface quality directly but he also receives valuable data with respect to the condition of the working rolls indirectly and hence in due time he can predict exactly the date when a roll has to be replaced.

‘Last but not least, using EMG-SORM 3plus the surface quality of cold-rolled steel strip can be planned better than ever. EMG-SORM 3plus is a system we could not now do without.’

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