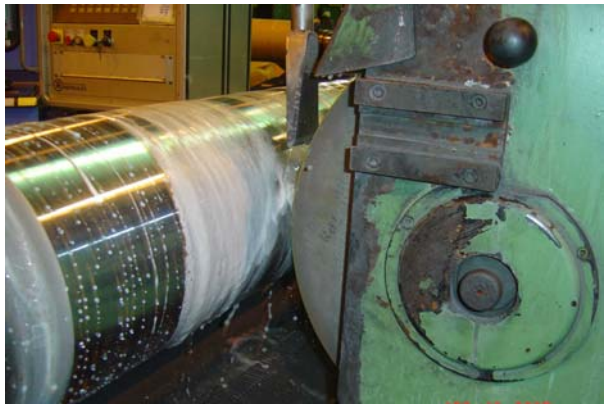
Rolling Metal

The Requirement

Precision ground or finished steel rolls play an important part in rolling of sheet metal (aluminium, steel, copper). Rolls with precise detailing are also used in printing and paper industries. Since the surface is exposed to continual wear during the process, the rolls have to be re-ground regularly.

Important criteria for the surface quality are therefore the roughness and roundness of the rolls. Methods used to check these until now (profilometers and manual roundness checking) capture only tiny line sections of the surface and differences from the edge to the middle are missed.

A fast non-contact measurement is desirable, capturing not only the roughness but also the roundness on many positions on the roll



Precision grinding of a steel roll (Photo: OptoSurf)

The Solution

The OptoSurf OS 500 scattered light measuring instrument, mounted on a support, can capture the roughness (using the optical characteristic value So) and also the roundness in a single measurement cycle. After processing and prior to the measurement, the surface is either wiped or blown clean in the local measurement area with compressed air.

The optical characteristic value, So, reacts to the roughness depth as well as to changes in the profile structure. Provided processing conditions remain constant, the So value can be compared with Ra or Rz after a single correlation run.

For roundness measurement it is a requirement that the measurement data capture be synchronised with the rotation speed. For a roll diameter of 600 mm, the rotation speed should not exceed 10 revolutions per minute.

OS 500 Sensor supported on a grinding machine (Photo: OptoSurf)

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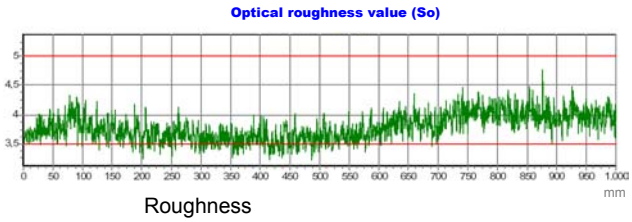
Roughness Results

The distribution of the roughness value, So, along the surface line of the total length of a roll shows clearly that the roll is smoother in the middle than in either end zone. Here the So value of 3.5µm corresponds to an Rz value of 1.8µm and So of 4.5µm to an Rz of 2.2µm. The run comprises 1,800 separate measurements and is completed within 2 seconds by the travel of the support with the sensor

The machine operator can therefore check the roughness depth achieved after each grinding pass, and make adjustments if the required value has not been reached.

The additional glossiness measurement after the final grinding, usual in the steel and aluminium industires, can be omitted when the optical roughness, So, has been measured, since this reacts well to changes in glossiness.

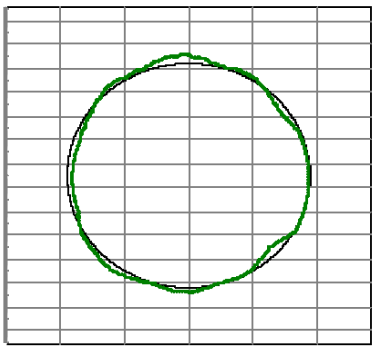


Roughness

µSo = 3,78 σSo = 0,23

ΔSo = 1,54

Roughness runout along the surface line of a 1 metre roll. The 1,800 individual measurements are linearly connected.
(µ: mean vlaue, σ: standard deviation, Δ: maximum swing)



Form

P+V = 14,13 µm

Exzentr. = 5,51 µm

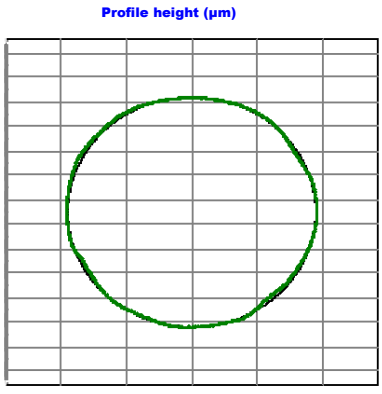
EW = 30 °

Roundness measurement at the edge of a 600 mm roll. Least squares circle calculation is shown, also the maximum circular deviation, peak-to-trough.

Roundness Results

Measurement data for a roundness measurement is captured during uniform (low eccentricity) rotation of the roll. For a 600 mm diameter roll, 8,192 angle measurements are made on the circumference and converted to profile values. The result is identical to a precision mechanical measurement. Calculation uses the least squares method, which yields the eccentricity of the rotation and the position of the two epicentres as well as the deviation from roundness (peak-to-trough). The accuracy is limited by the eccentricity of the rotation axis.

In the measurement shown, the error is noticeably different at the edge from the middle.



Form

P+V = 5,34 µm

Exzentr. = 15,27 µm

EW = 181,83 °

Roundness measurement in the middle of a 600 mm roll. Least squares circle calculation is shown, also the maximum circular deviation, peak-to-trough.

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