ONLINE SURFACE INSPECTION IN FOIL ROLLING MILLS

RMD Roll Mark Detector System

FEATURES

- Optical Foil Surface Inspection
- Installation in Foil Rolling Mills
- Detects / Classifies Repetitive Work Roll Marks & Holes
- Surface Defect Size < 200µm
- Up to 2000m/min Rolling Speed
- Up to 2200mm Foil Width
- Compact and Rugged Sensor Head
- Adaptable to Various Foil Mill Makes / Models
- Permits Immediate Operator Reaction to Prevent Reject Coils

RMD - Benefits

The main benefit of the system is that it allows an immediate reaction to really avoid defects rather than just counting and recording them at the end of a coil. The benefits of the RMD system certainly depend on individual plant parameters and quality strategies. The occurrence of critical roll marks spoils considerable amount of thin & heavy gauge foil per month in a typical universal, intermediate or finishing foil mill. Hence, the RMD capital investment cost can be “returned” within few months.

- Enables immediate Reaction to Stop Rolling
- Increases Foil Mill Efficiency
- Minimizes Scrap and on Hold Production
- Supports Automated Quality Control
- Helps Mill Operators and Process Engineers
- Improves overall Quality in Foil Rolling Process

RMD - References

At present (March 2008) more than 20 systems are successfully commissioned in several major rolling plants world wide. Repeated orders from most of the plants prove that RMD achieves a fast ROI and that productivity as well as process efficiency is considerably being increased.

Customers comment on RMD, who has 3 systems installed:

"The Rollmark detector is one of the great events of last 10 years in rolling technology!"......

Related Products

- RMD Roll Mark Detector System
- RSIS Roll Surface Inspection System
- PIA Pin Hole Analyzer
- PIA Pin Hole Analyzer
- ROLL SURFACE INSPECTION IN ROLL GRINDER MACHINES
- ALUMINIUM FOIL INSPECTION

Features

- 100% Optical Surface Scanner for Ground Rolls
- Installation in Roll Grinder Machines
- Detection / Classification of Surface Patterns & Scratches (Chatter, Feedlines, Shadows, Twists, Diagonals…)
- Chatter Frequency Analysis
- 2D Surface Pattern Imaging, Grading
- Integrated into Grinder Operation

Features

- Analyzes Aluminium Foil Samples
- Measures and Classifies Pin Hole Occurrence within a Surface Area of 100 x 100mm
- Statistical Product Quality Monitoring in Rolling and Converter Plants
- Supports Operators Visual Light Table Inspection by Objective Measurement of Pin Hole Counts, Diameter Distribution down to 5µm
Typical Roll Marks in Heavy and Thin Gauge Foil

- Pin holes above a certain size are unacceptable flaws in foils.
- A slightly damaged work roll imprints repetitively roll marks into the surface continuously downstream the foil.
- Using the RMD technology it is now possible to detect roll marks and roll holes at highest production speed during foil rolling, on the fly.

In case a critical surface problem shows up, the operator can immediately stop the mill, thus “saving” tons of reject material and hours of wasted production time.

**RMD - Objectives**

In modern foil rolling mills automated control of strip gauge, shape and other product parameters is state-of-the art since many years. However, monitoring of the foil surface today is still based on human visual inspection. Samples are typically checked offline on a light table after a coil is produced. The objective of the RMD Roll Mark Detector is to close this “gap” and to provide a new powerful ONLINE surface inspection scanner for operators and process engineers.

Roll marks are periodical surface defects on the strip. A slightly damaged work roll imprints repetitively roll marks into the surface continuously downstream the foil.

**The challenges for this application are**

- Very High Production Speed Range of the Rolling Process up to 2000m/min
- Hard Mill Environmental Conditions (Temperature, Kerosene Vapour, Sporadically Fires, Strip Break etc)
- Tiny Size of the Defects to be Revealed (<0.2mm)
- Restricted Space Available in the Mill

A work roll damage occurs mainly when hard grains (e.g. oxide particles, metal, grit) infiltrate the rolling gap. The risk to affect the roll surface tends to be highest after a strip break or right after starting a new coil.

Especially in foil rolling, these small, punctual roll marks are highly critical because in the pre-finish or finish passes they finally cause pin holes (pierced marks). Thus, an entire coil of several tons of thin gauge foil might be rejected after hours of rolling if it’s spoiled by a continuous pin hole “street” along the foil.

Pin holes above a certain size are unacceptable flaws in foils used as barrier in dairy, pharmaceutical or other packaging products.

**RMD - System**

The system consists of the following main components:

1. Rugged Sensor Head
2. Servo Motor Driven Linear Scanner System
3. Signal Conditioning Unit & Mill Interface
4. Data Acquisition Unit and Computer System

**RMD Technical Data**

- Distance to strip: typ. 4mm
- Scan Time: Cross Web ca. 5min
- Sensor Head Dimension: ca. 110 x 110 x 50mm (adapted to mill geometry)
- Detection Efficiency: typ. 80% - to 95%
- Temperature: <100° C (at sensor head)
- Atmosphere: Kerosene Vapour
- Miscellaneous: fire resistant

**RMD - Results**

The operation and the operator interface are straightforward and easy to use. The main screen shows any roll mark occurrence as a vertical bar inside a graph that represents the foil width. The height of the bar gives the relative defect size and its x-position indicates the position on the foil (referenced to the foil edge). The system status and rolling history information are provided.

**RMD - Objectives**

- Measuring the foil surface before the finish pass with a resolution of 2000m/min is possible.
- The system is mounted in the exit section of a foil mill close to the shape control roll or the tucking roll.
- Without RMD installed these marks generally remain unnoticed, thus, causing pin holes after starting a new coil.
- The operating principle is based on the fact that spoiled work rolls generate repetitive defects (streets of marks) on the foil.
- Using the RMD system to reduce system complexity. RMD covers only one small foil section at a time.
- The sensor head scans across the foil step-by-step and explores the strip surface through an “inspection window” of 4mm width.
- A laser line illuminates the surface. The reflected, scattered light is measured by a proprietary photo sensor arrangement. Analog signals are continuously digitized, analyzed, and classified by sophisticated digital signal processing algorithms. Efficient analysis is especially important to distinguish the tiny “real” marks from oil and other surface contaminations during rolling.
- Surface anomalies are reported to a Computer (PC), which acts as the operator’s console. The PC evaluates and displays cross web roll mark profile, size of roll marks (severity level), location of marks, work roll history etc.
- Moreover, the PC provides coil reports, data archive onto disk and alarm PLC outputs.
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**Typical RMD Sensor Head Implementation**

Typically the available space in the exit section of foil mills is limited; thus the size of the RMD front end parts is a critical parameter. However, up to now all inquiries it was possible to upgrade and adapt the RMD system to any mill layout, independent of its model. In our applications, we mainly have two alternative mounting situations: the sensor “looks” either from the top or from underneath the tucking roll.

**RMD Technical Data**

- Light Source: Laser Light
- Sensor Cells: 3mm per strip
- Typ. 4mm
- Scan Time: Cross Web ca. 5min
- Distance to strip: typ. 4mm
- Sensor Head Dimension: ca. 110 x 110 x 50mm
- Adapted to mill geometry
- Detection Efficiency: typ. 80% - to 95%
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When a critical surface problem shows up, the operator can immediately stop the mill, thus “saving” tons of reject material and hours of wasted production time.

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