Development of a New On-Line Sensor for Steel Surface Contamination



Sarclad and CRM Group have developed a new on-line sensor for steel strip contamination. The system utilizes laser-induced breakdown spectroscopy to give a continuous and real-time assessment of the contamination levels post-cleaning on a typical steel strip processing line. Critically, this is the first system available that can distinguish between surface carbon and iron fines contamination with quantitative data. This will enable the highest product quality alongside optimized core cleaning section parameters to give the greatest process efficiency. This article describes the technology used, its advantages and performance in industrial trials, and addresses the practical considerations of implementing the technology in the commercial industrial environment.

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Introduction

Strip processors, and in particular galvanizers, have long been looking for a way to measure the residual contamination of the substrate surface accurately and reliably at the exit of the cleaning section. This is indeed a key parameter for the quality of coated steel, especially in the automotive sector, where there should be no surface defects.

The contamination sources are various, but two main pollutants are generally mentioned: surface carbon from mill oil and iron fines. In the long term, carbon will turn into soot in the furnace, reducing its efficiency, and will eventually fall onto the rolls and the strip. Iron fines can create pickup defects on the rolls and increase the dross content in the zinc bath by combining with zinc and aluminum, leading to a drift in the bath composition. In addition, all these problems can result in aspect defects on the final product.

If residual contaminations are continuously monitored on-line, corrective actions can be planned before being forced to downgrade a whole production due to aspect defects. In addition, if the contamination source can be differentiated from the others, its cause can be quickly identified and eliminated by making targeted corrections to the cleaning section.

CRM Group and Sarclad have therefore developed new on-line equipment able to differentiate between iron fines and surface carbon pollutions. This equipment uses a laser-induced breakdown spectroscopy (LIBS) method developed by CRM Group.[1] It can be placed at the exit of the cleaning section in galvanizing lines to measure the residual contamination levels. This article describes the work carried out to achieve this on-line monitoring with a LIBS-based sensor and the engineering developments to create the Sarclad Contamination Monitoring System, a device ready for installation and integration into any strip processing line.

Discussion

Introducing Laser-Induced Breakdown Spectroscopy

LIBS is a spectral analysis technique with many applications in geology, metallurgy and other physical sciences. Over the years, it has been implemented in several industrial environments with its robust design