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Sanyo Special Steel Co., Ltd.

Development of a steel identification system analyzing spark image

Sanyo Special Steel Co., Ltd. (President: Shinya Higuchi, Head Office: Himeji, Hyogo) developed a steel identification system by spark tests to distinguish types of steel, in joint research with Tokyo University of Science (President: Akira Fujishima; Shinjuku, Tokyo).

A spark test is one of inspection processes to identify steel grades from the shape and color of sparks. We aim to make spark testing more sophisticated by replacing a sensory test, where identification is based on a worker's visual observation of sparks, with a machine test, where identification is based on data analysis using a computer in this development.

To achieve this, we used image analysis technology. We developed a system for identifying the carbon content in steel by photographing sparks, which change according to the steel's composition, and then analyzing the images to comprehend the characteristics of the sparks. Replacing spark testing that currently depends on the proficient skills of workers with testing using machines is expected to improve test accuracy and stability.

We have installed the machine with the newly developed steel identification system at manufacturing sites on a trial basis, and we plan to proceed with verification of the system for practical application in the future.

◆Background of the development of the steel identification system and its characteristics

A "spark test" is a test for identifying the constituents of steel material and their content based on the characteristics of sparks (such as shape and color) observed from scattering sparks when the material is applied to a grinding wheel. A spark test is used as one testing procedure for ensuring that the steel type and control data are consistent. When there is an increase in the carbon content of steel, there is typically an increase in the amount of sparks and bursts generated (see Figure 1). Therefore, these characteristics are identified by the human eye.

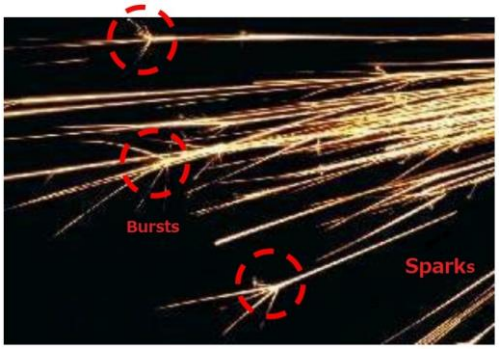

Figure 1: Example of sparks and bursts

Nevertheless, identifying such characteristics requires highly developed skills, and factors such as difficulty in mastering the spark test in a short time and the need for further test stability necessitated replacement of the sensory test through automation.

In 2010, we commenced joint research with Professor Hiroshi Kobayashi of the Department of Mechanical Engineering, Tokyo University of Science. We developed a system capable of identifying different types of steel by photographing the sparks and determining their characteristics through image analysis. Recently we introduced this system (see Figure 2) on a trial basis for practical verification. We established the conditions for photographing sparks with a high-speed camera to ensure the machine would perceive the characteristics of the sparks in the same way as the human eye does.

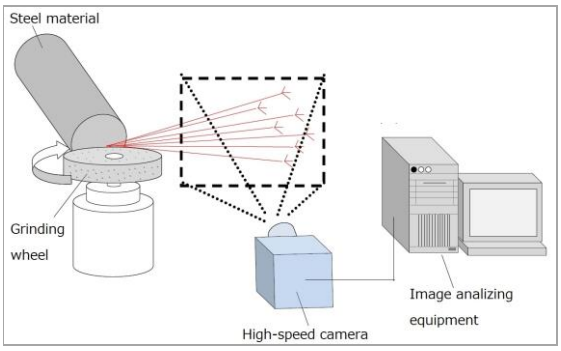

Figure 2: Schematic layout of the test machine

A new image analysis program (Patent No. 5706233) installed in the image processing unit has improved the accuracy and speed of image analysis, which had been an issue in existing programs. The machine continues to accumulate data for practical application. By calculating the volume of sparks and number of bursts through image analysis and assessing their ratios, the machine is capable of identifying the carbon content in steel to within ±0.05%.

As one of the principles of our 10th Medium-Term Business Plan, we are promoting “further pursuit of technological superiority through enhancement of R&D and quality competitiveness.” We will continue to focus on improving product quality through development of technologies, including the development of the steel identification system analyzing spark image.

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