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Application News

No.P94

Electron Probe Microanalyzer

Microanalysis by EPMA

In recent years, in step with progress in nanotechnology, a variety of industrial products have been miniaturized, reduced in quantity, and made more precise. In addition, since all manufactured products consist of substances that exist on the Earth, where resources are limited, progress is being made to reduce their consumption, particularly with respect to limited resources such as rare metals, and also to develop materials that do not contain hazardous elements. Accordingly, nanoparticle-based materials are increasingly being used, with higher demand for high-sensitivity, high-resolution analysis in the microscopic region.

The electron probe microanalyzer (EPMA) is conventionally known as high-sensitivity surface analysis equipment for microscopic areas, and is currently used in a wide range of fields for various purposes.

Recently, the highly popular CeB6-EPMA has been used for measurement of microscopic regions in research and development and for defect analysis in on-site quality control, as it can provide more sensitive, higher resolution image observations and elemental analysis than the conventional W-EPMA.

This paper presents data from high-sensitivity analysis in microscopic regions for catalytic materials and steel materials.

Platinum in Ceramics

Ceramics with noble metals supported on oxides are very familiar. Of all the noble metals, platinum (Pt) in particular is not in itself very reactive, but causes other substances to mutually react, making it an extremely valuable metal. However, Pt reserves on the Earth are said to be extremely small, and in recent years, measures have been taken to reduce its consumption. In catalytic development, the miniaturization of Pt particles and the establishment of high-efficiency dispersion methods have become important themes.

Fig. 1 shows images of nano-sized Pt particles for observation and for an evaluation of their dispersiveness via elemental mapping analysis.

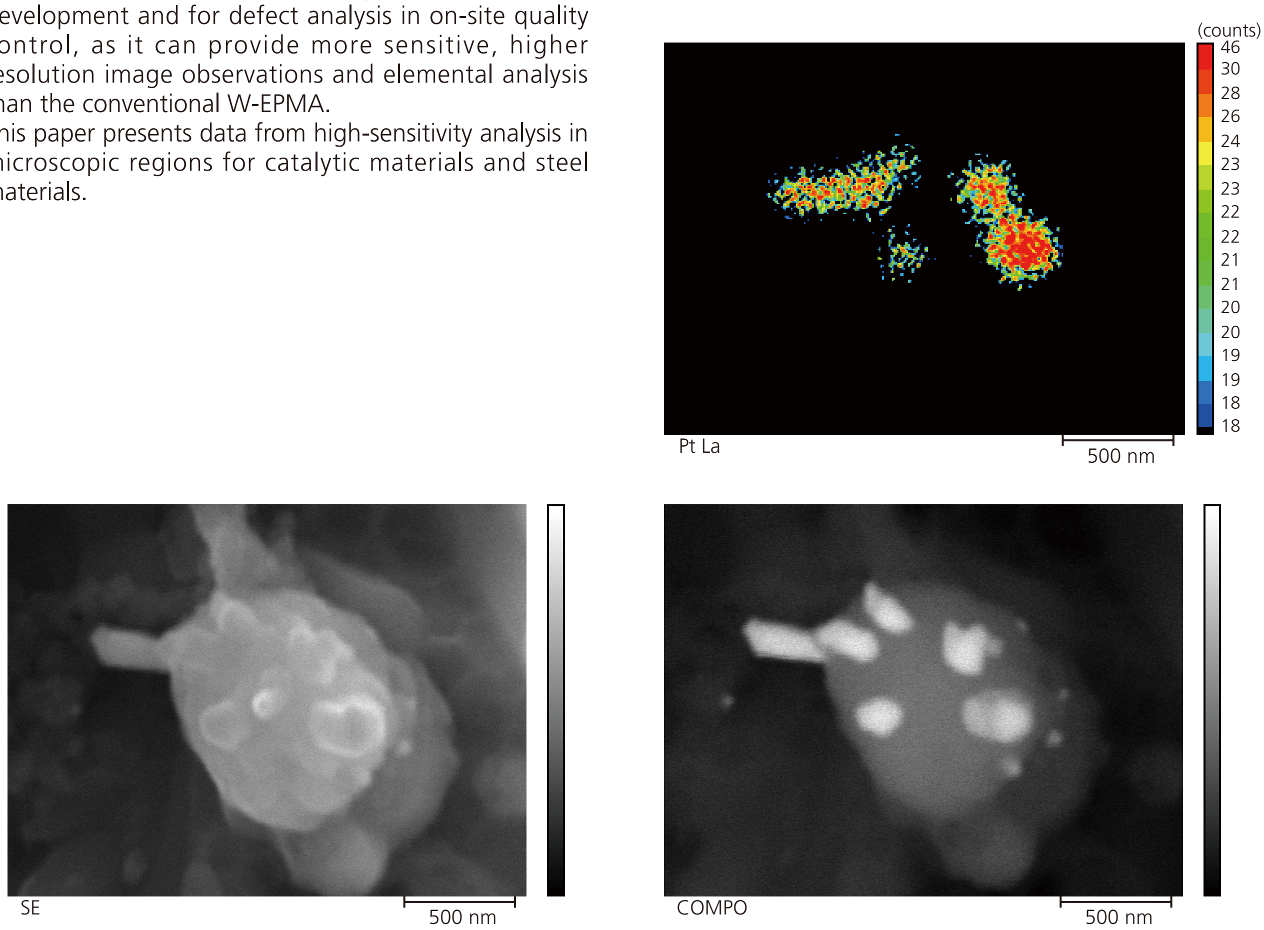

Fig. 1 Pt Elemental Mapping Image

Non-Metallic Inclusions in Steel

In steel material production, sulfides, silicon oxides, nitrides, and carbides that remain in the steel during the fusion and refining process, or precipitate due to changes in solubility during the cooling and solidification process, or precipitate during the heat treatment process, are referred to as non-metallic inclusions. In JIS, non-metallic inclusions are classified into three types: Type A (sulfides, silicates, etc.), with viscous deformation caused by hot processing; Type B (alumina and other oxides, and carbonitrides), which forms into groups in the processing direction and lines up as discontinuous particles; and Type C (oxides and carbonitrides), dispersed irregularly without viscous deformation.
Non-metallic inclusions can have a significant effect on the mechanical characteristics (toughness, fatigue resistance, and non-aging properties) of steel, depending on their form, size, dispersion, and other precipitation conditions. For this reason, it is important to control the manufacturing conditions for steel materials that produce many types of non-metallic inclusions.
Depending on the components that make up the steel, crystal particles are miniaturized by hot processing, and carbides, nitrides, and other microscopic particles precipitate, improving the material properties.
In this way, investigating the non-metallic inclusions and precipitates in steel is very important in terms of understanding the properties of the steel. However, the various non-metallic inclusions and precipitates subject to investigation are very minute, and high-sensitivity, high-resolution analysis performance is required.
The elemental mapping data in Fig. 2 reveals that sulfide non-metallic inclusions exist in the sample. From their form, it is evident that they are coexistent with extraneous inclusions.

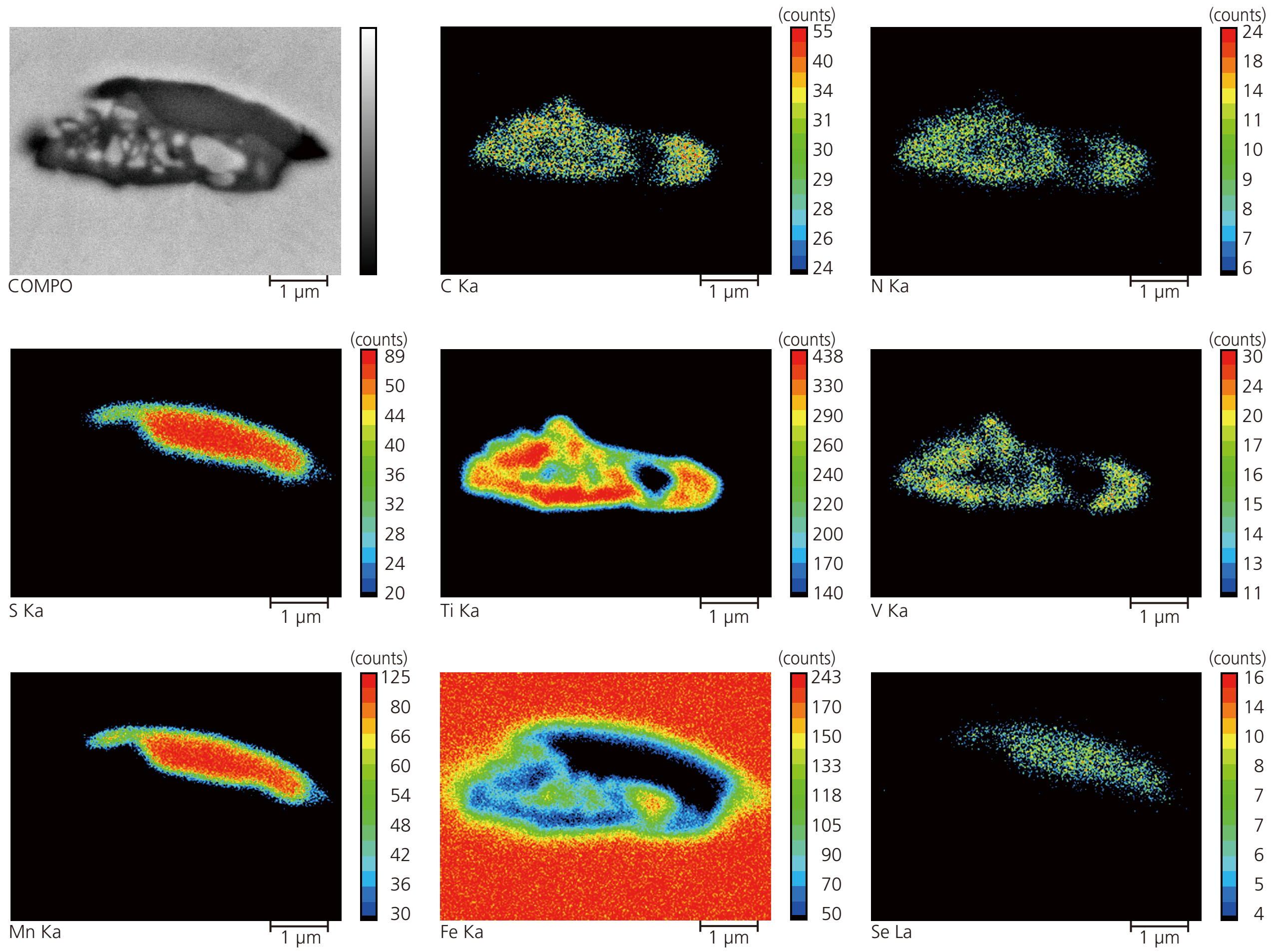

Fig. 2 Elemental Mapping Images for Non-Metallic Inclusions

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