

Inconsistency between SEM image and Crystal orientation data obtained by SEM-EBSD systems

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Recently, a scanning electron microscope (SEM) equipped with electron back-scattering diffraction (EBSD) have become a strong and common tool to obtain the crystallographic information from minerals and various materials. SEM-EBSD can evaluate not only crystal orientations of individual crystals but also alignment property of crystal orientations in a wide area. For obtaining the crystallographic information by an SEM-EBSD system, we need a software program to detect and analyze EBSD (electron back-scattering diffraction pattern), which is generally developed by EBSD-detector vendors or some laboratories.

El-Dasher et al. (2009) reported the possible inconsistencies between SEM images and crystal orientations obtained by SEM-EBSD systems. However, this crucial problem has not been widely known. In this presentation, we will report the result of experimental tests about this problem performed in our laboratory.

We carried out a series of experiments using our SEM-EBSD system consisting of JEM-7001F (JEOL) and HKL channel 5 (Oxford instruments). Single crystals of Si, corundum, and quartz with known crystal planes were used in the experiments. The crystal plane was set with its typical axis slightly tilted for easier analysis and discussion. Trigonal or orthorhombic crystals are more suitable for this test than that with the cubic crystals in order to avoid the confusion by equivalent orientations.

We confirmed the systematic inconsistency between SEM images and crystal orientations obtained by HKL channel 5. The orientation shown by HKL channel 5 was just consistent with the SEM image rotated by 180 degrees around the sample normal direction. The same inconsistency may occur in many SEM-EBSD systems in other laboratories. We will also report the cases for other combinations of SEMs and EBSD-detectors.

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