

Materials Informatics and Digital Transformation System for automotive material development.

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Material informatics (MI) is one of the approaches to shorten duration of material research and development. Data science which is a part in MI requires characterized data from spectra and/or images, accumulation and utilization of data. The outline of data characterization and storage system with examples of magnetic material development will be introduced.

The implementation of MI can be classified into the following four steps; measuring materials to obtain spectra or images, characterizing them to extract features, accumulating the characterized data, and statistical analyzing. The achievement of characterization and statistical data analysis with a short period is a fundamental component in a success of MI. However, the following problems arise; the characterization quality depends on person and it take longer when the characterization process is not defined. Because only little rule exists about data storage, some sample fabrication and characterization have been done to make data. The system which can solve above problems has been developed and its efficiency has been confirmed(Fig. 1).

In the system, two different characterization methods have been developed. One is based on a principal of physics such as identifying phases in a XRD pattern. Another one is based on a machine learning which is extracting a difference among data set such as principal component analysis of spectra or images.

For feature extraction focusing on individual data, in the case of

X-ray diffraction (XRD) data, the included phases are identified and the crystallite diameter is calculated. In the case of a microscope image, the size and number of grain shapes contained are extracted as quantitative values. On the other hand, in feature quantity extraction focusing on the similarity between data, spectra and image data are featured using a dimension reduction method. The process of aligning the difference in data size and measurement step width, which is a problem when handling multiple data, is also automatically performed. As above, being merged these characterized XRD and SEM data set, the statistical data analysis become possible.

It has been confirmed that the system enables us to shorten the time to analyze material data and improve quality of characterization. The possibility of shorten duration of material research and development was shown.

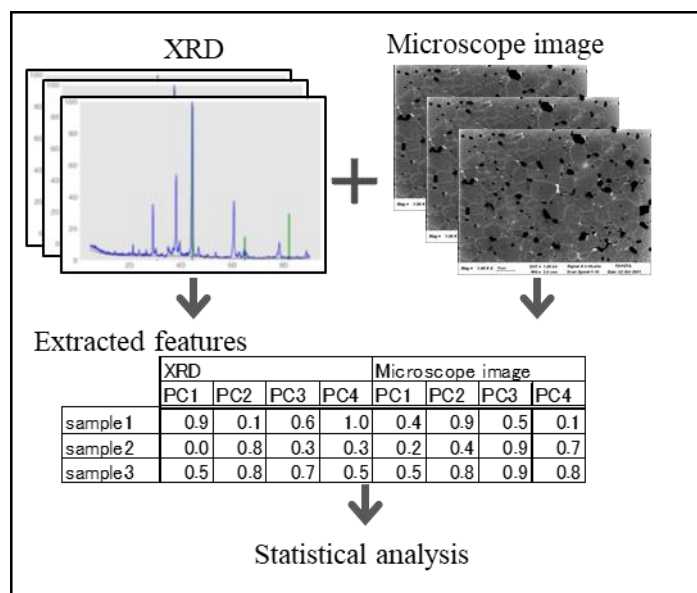


Fig.1 Overview of System