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Morphologically Directed Raman Spectroscopy 法による鉱石粒子の新規な粒子形態調査
A Novel Particle Morphological Investigation of Mineral Ore Particles by A Morphologically Directed Raman Spectroscopy

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[Introduction]

To investigate of the mineral resources as particles such as soil in sea, in ground and in fields is interesting in geochemistry. The existing approach to investigate of mineral resources, the manual microscopic observation method and an elemental analysis technics had been used.The major drawback of a manual microscope approach has been used for few number of particles morphology observation. It is not able to described particle shape as significant number. Furthermore an elemental analysis technique such as X-Ray fluorescence and destructive wet chemical analysis can determine the quantity of mineral species present in the ore, however, these chemical analysis methods do not allow the study of the composition of individual particles of different size and shape. The morphologically directed Raman spectroscopic (MDRS) is a novel approach which can resolve this problem. Using this method the Raman spectra of several hundred particles is determined after size and shape classification of each individual particle by automated particle image analysis. Raman spectroscopy can be used to acquire the spectra of any inorganic compounds such as metal oxides and nitrides which are Raman active. Many mineral resources are mined as inorganic compounds. Therefore, Raman spectroscopy can be used for the identification of the chemical composition of mineral ores. Using the a morphologically directed Raman spectroscopic method described herein, it is possible to calculate the particle size distribution and proportion by mass or volume of each chemical component or mineral species based on Raman spectroscopic information. This study will report and discuss the capability MDRS method using a model material.

[Material and Method]

These samples had been through the ore dressing process. MDRS measurement was carried out using a Morphologi G3SE-ID instrument (Malvern Instruments, UK) equipped with a dry powder sample dispersion unit (SDU) and Raman module. The laser wavelength of Raman excitation was 785nm the laser power was less than 5mW and the irradiation time was 5 sec. The particle image measurements were made in diascopic mode with a total magnification 250x. Iron ore dry powder samples were dispersed using the SDU using a short duration pulse of compressed air.Measurements were made automatically using Standard Operating Procedures (SOPs) which define the software and hardware settings used. Measurement sample was dispersed on to glass plate as sample carrier which was minimized environmental exposure by the enclosed sample chamber unit. Particle identification by Raman analysis used the spectrum correlation coefficient approach.

キーワード: 粒子径, 粒子形状, モルフォロジ, ラマン分光, 資源分析
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