論文内容要旨（英文）

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論　文　題　目

Research on observation and analysis using sample carriers with the application of MEMS technology.

This thesis describes the development of a sample carrier that utilizes micro-electro-mechanical system (MEMS) technology to form a micro-cell array structure and freestanding thin-film window structures in order to overcome the challenges of conventional sample carriers and to create novel observation and analysis methods that have been difficult to apply. The thesis also describes efforts to establish analytical and observational methods using the developed sample carriers, from new sample preparation and application to new sample loading methods.

This thesis is organized as follows. Chapter 1 describes background and research purpose. In Chapter 2, thin and uniform deposition of slight amount of minerals was achieved from wettability control by a micro-cell array structure formed on a polymer film by MEMS technology. Furthermore, the calculated mineral content values obtained from the X-ray fluorescence quantitative analysis were found to correlate with the certified values. Chapter 3 describes the fabrication of sample carriers with silicon nitride (SiN) thin film windows by applying the SiN thin film large window formation method in Si micro-chips to sample carriers using MEMS technology. In addition, the fabrication method was improved to a practical level by suppressing the formation of fine particles during the fabrication process. In Chapter 4, the application of a sample carrier equipped with a SiN thin film window to correlation microscopy techniques using transmission electron microscopy and polarized light microscopy was investigated. The advantages of each method, such as molecular orientation information and nanoscale morphological features, were successfully combined. Furthermore, machine learning was used to find a method to calculate the degree of crystallinity. In Chapter 5, new sample carrier was studied to combine the wettability control by the micro-cell array with the SiN thin film window technology. In addition, a jig to supplement ultra-thin sections was developed. By combining these two elements, it was found that ultrathin sections can be mounted on the hydrophilic part of the sample carrier by self-alignment. Chapter 6 discusses the conclusion of this thesis.