

Design of a 5-DOF Specimen Stage and Multiple-Specimen Exchange System for Transmission Electron Microscope

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Many efforts to improve the performance of the Transmission Electron Microscope (TEM) have focused on the electron optical systems and the irradiation systems, but recently, besides the fundamental performance aspect, several efforts have also been made to increase the efficiency of the electron microscopy and the utilization of the TEM.

As one of these recent efforts, in this presentation, i) a 5-degree of freedom (DOF) specimen stage that can freely change the attitude of the specimen, and ii) a specimen exchange system that can automatically exchange several specimens prepared before the sample observation.

The 5-DOF specimen stage is designed by applying a parallel mechanism and it is possible to implement motion of 5-DOF, i.e., translational 3-DOF and rotational 2-DOF. The automatic sample exchange system developed for increasing the analysis efficiency using the 5-DOF specimen stage can load up to 10 specimens at the same time. The specimen is mounted on a small cartridge, and 10 cartridges are mounted on the sample exchange device. The cartridge can be mounted or dismounted on the 5-DOF stage using small forceps. Finally, the development of the TEM auxiliary devices, i.e., the above 5-DOF specimen stage and the specimen exchanger is presented, simplified inverse kinematic analysis of the 5-DOF specimen stage and manipulation performance measurements at the optical level are discussed.