

Development of objective aperture holder capable of mounting ACE corrector and ACE corrector control system for aberration corrected SEMs

Motomura, S.¹, Nomaguchi, T.¹, Yamashita, M.¹, Noguchi, H.¹, Nishinaka, K.¹, Agemura, T.¹, Kawasaki, T.², Yoshida, R.² and Kato, T.²

¹ Hitachi High-Technologies Corporation, Japan, ² Nanostructures Research Lab., Japan Fine Ceramics Center, Japan

A unique idea for correcting a spherical aberration (Cs) of electron microscopes was proposed by Kawasaki et al. in 2016 [1]. The corrector, which was named ACE corrector, is composed of an Annular and a Circular Electrodes (ACE), and a voltage of several volts is applied between them. A schematic diagram of ACE corrector is shown in Figure 1. A concave lens effect is generated on the annular slit by applying the voltage, and it can cancel the Cs of an objective lens. According to this theory, a resolution of a scanning electron microscope (SEM) would be easily improved if two electrodes could be mounted instead of a standard aperture having a single hole. That is why we are developing an objective aperture holder capable of mounting the ACE corrector and a control system for it.

3D-CAD models of the developed holder are shown in Figure 2. The holder allows us to mount 4 aperture units and select from ACE correctors and/or standard apertures. Therefore, a high-resolution mode using the ACE corrector and an analysis mode needed high current are incorporated together in a SEM. In addition, each mode can be switched by a computer of an evaluation apparatus which is a Field Emission SEM SU5000 (Hitachi High-Technologies Corp.) since the holder is equipped with electric motors and the ACE corrector control system is embedded in the software of SU5000. One of the advantages of the ACE corrector is that users can start the HR observation quickly after optical conditions such as accelerating voltages change. In terms of this point, the control system helps users to apply suitable voltages of the correctors in order to provide its performance smoothly. The developed holder and system are expected as a function added new value to the conventional SEMs.

[1] T. Kawasaki, et al., *Suf. Int. Anal.*, 48 (2016) 1160

Acknowledgement:

This development was supported by SENTAN, JST.

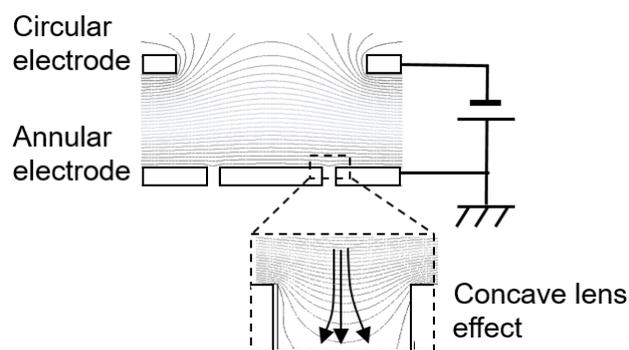


Fig 1. Schematic diagram of an annular and a circular electrodes corrector (ACE corrector).

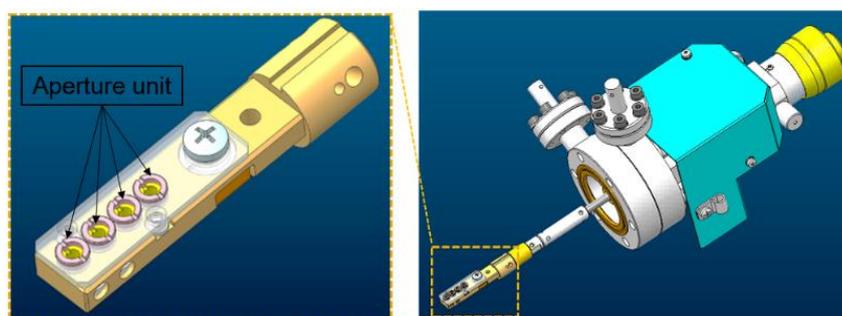


Fig 2. 3D-CAD models of a developed objective aperture holder capable of mounting ACE correctors.