

## **Control of a double-stage deflection coils in transmission electron microscope**

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We introduce a control of deflection coils in homemade transmission electron microscope. The homemade transmission electron microscope consists of an electron gun, an illumination system, an objective lens and an imaging system. In the transmission electron microscope, it is very important that the electron beam is irradiated along an optical axis. The deflection coils is used to align the electron beam to the optical axis. The alignment operation has two modes, "shift" and "tilt". By using the "shift" mode, the electron beam is controlled to be irradiated in parallel with the optical axis. The "shift" mode can be implemented with double "tilt" operations. A double-stage deflector is used to realize the double "tilt" operation. In this study, we show how to control the double-stage deflection coils for the "shift" operation. In order to realize the "shift" mode, it is important to find a ratio of excitation of the upper and lower. The upper and lower deflection coils are designed by a quadrupole type, respectively. A homemade inspection tool is used to find the ratio. The inspection tool consists of a 4-degree of freedom (X-Y-Z-T) stage, a specimen holder, a small phosphor screen, and two digital cameras. And a thermionic electron source (a tungsten hairpin type filament) is used.