

Soft x-ray ellipsometer using free-standing multilayer polarizer

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ABSTRACT

Semitransparent Mo/Si multilayer films with a completely free-standing active area have been developed for use as optical elements in the soft x-ray region. They work not only as a beam splitter, but also as a transmissive polarizer and quarter-wave plate. A multilayer film consisting of 50 free-standing pairs of semitransparent Mo/Si were fabricated for transmissive polarizer, and a soft x-ray ellipsometer was developed based on them. The fabricated multilayer polarizer was found to have good polarization performance. Placing two transmissive polarizers in the polarizer / compensator - sample - analyzer configuration enabled full control of the polarization of the probe beam. The modified polarization of light reflected from a sample was analyzed by the rotating-analyzer ellipsometry method. This system was used to measure a multilayer mirror. Large oscillations in the ellipsometric angles in accordance with the periodic structure of the film were observed. From these measurements, we can determine all the parameters of a multilayer structure. The accuracy of the multilayer period was 0.01 nm. An analysis using two different models--interface roughness and interdiffusion--demonstrated the feasibility of using a soft x-ray ellipsometer to understand the nature of the interfaces of multilayer films.