

Interpretation of interfacial structures in X-ray multilayers by TEM Fresnel fringe effects

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Assessment of interfacial structures from high-resolution TEM images of cross-sectional specimens is difficult due to Fresnel fringe effects producing different apparent structures in the images. The effects of these fringes have been commonly over-looked in efforts of making quantitative interpretation of interfacial profiles. In this report, we present the observations of the Fresnel fringes in nanometer period Mo/Si, W/C, and WC/C multilayers in through-focus-series TEM images. Calculation of the Fresnel fringes of a Mo/Si multilayer using charge density approximation is used to illustrate the characteristics of the fringes from different interfacial structures. We find that the potential difference and the abruptness of the interfacial composition change are a strong function of the fringe contrast, while the fringes spacing depends more strongly on the thickness of the transition or interfacial layer.

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