# Soft X-ray Reflectivity and Scattering

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The reflectivity and non-specular scattering of soft x-rays from a rough surface will be reviewed. Just as in the conventional hard x-ray region, soft x-ray scattering measurements can be used to investigate the propagation and growth of roughness in thin films and multilayers. In addition, there is a practical need to understand the effects of scattering in a multilayer coated imaging system such as those being developed for EUV lithography. In this tutorial, the following topics will be touched upon:

1) The Statistical Description of a Rough Surface
   a) The Power Spectral Density and Bandwidth-Limited Roughness
   b) The Height Correlation Function
   c) Self-Affine Surface Roughness
   d) Examples of Typical Substrates
   e) The Measurement of Surface Roughness
   f) Roughness of a Thin Film

2) Scattering from Rough Interfaces
   a) Diffraction Theory
   b) Distorted Wave Born Approximation
   c) Isotropic versus Anisotropic Roughness
   d) Scattering from a Thin Film
   e) Scattering from a Multilayer
   f) Skew Replication of Roughness

3) Scattering in an Imaging System
   a) Reduction in Multilayer Reflectivity
   b) The Effect of Scattering on the Point Spread Function
   c) Flare and Image Contrast Reduction