Impact of grating line roughness in the resonant diffuse scattering

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Lamellar gratings can be found in several applications, from diffractive optics to structural elements in integrated electronic circuits. With the decreasing feature dimensions, the characterization of such structures needs of a metrology tool capable of rapid and non- destructive measurements, but at the same time very sensitive to the imperfections. EUV scatterometry has been proved to be a suitable technique, which due to the short wavelength also highlights the roughness contributions. The uneveness of the lines affects, not only, the performance of these structures, but also influences their reconstruction by solving the so-called inverse problem of scatterometry. Line roughness is usually separated into line edge or line width roughness, which we have also considered for the study of the roughness induced scattering. We have analysed a set of gratings by EUV scatterometry, where each of the gratings has a well-defined amplitude and type of line roughness. The obtained scattered patterns show a strong correlation of the angular scatter distribution according to the type of line roughness, which is not covered by the existing analytical methods. These distinct scatter distributions allow for new approaches in the characterization of nanostructures by EUV scatterometry.