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Raman spectroscopy for dimensional metrology in semiconductor nano-electronics

Thomas Nuytten
IMEC, Belgium
thomas.nuytten@imec.be

Abstract

As the dimensions of semiconductor device architectures shrink, the need for precise control and metrology of the pitch and critical dimension (CD) throughout the different processing steps becomes of paramount importance. Recently it was found that through control of the experimental parameters, a dramatic enhancement of the Raman response from periodic semiconductor structures is achieved, re-enabling the use of Raman spectroscopy for deep-subwavelength structures. As it turns out, the coupling of light into the structure is exceptionally sensitive to the parameters that define the periodicity, i.e. the pitch and CD. The profound understanding of this enhanced light coupling has opened a plethora of metrology applications based on the analysis of the Raman scattering originating from these nanogratings. We will show how as such Raman spectroscopy is able to probe not only mechanical stress and composition but also critical dimension at the nanoscale.