

Spectroscopic ellipsometry as an *in-situ* diagnostic tool for the avoidance of compound layer formation during plasma nitriding

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With the shrinking of semiconductor devices surface features and structuring become increasingly important.

Plasma nitriding was studied in detail *in-situ* on steel substrates (material code: 1.7225) via spectroscopic ellipsometry in order to avoid the formation of a compound layer. The aim was to identify the compound layer formation by analyzing differences in the dielectric function within a certain energy range. Very long nitriding times resulted in a compound layer formation gaining a so-called transition region of the evaluated signal. For comparison steel substrates without a compound layer were produced. In these cases the process was interrupted at different durations of treatment within the transition region. Criteria have been worked out to obtain samples with the wanted surface structure (compound layer or only diffusion layer). To get more information about the phase composition several X-ray diffraction (XRD) measurements were carried out. It turned out that the compound layer composition is iron nitride consisting of only Fe₄N. Atomic force microscopy (AFM) images revealed an increase of the surface roughness in the course of the nitriding step especially within the transition region.

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