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Surface characterization after subaperture Reactive Ion Beam Etching

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In usual ion beam etching processes using inert gas (Ar, Xe, Kr...) the material removal is determined by physical sputtering effects on the surface. The admixture of suitable gases (CF_4 + O_2) into the glow discharge of the ion beam source leads to the generation of reactive particles, which are accelerated towards the substrate, where they enhance the sputtering process by formation of volatile chemical reaction products.
During the last two decades research in Reactive Ion Beam Etching (RIBE) has been done using a broad beam ion source. This procedure of surface treatment exhibits the advantages of a large homogeneously working diameter and large etching rates due to the admixture of reactive gases. The main disadvantage of this procedure is the limitation of the sample size (diameter sample < diameter beam) and surface shape (nearly planar). To solve these problems our goal was to apply a sub-aperture Kaufman-type ion source in combination with an applicative movement of the sample with respect to the source, which enables us to etch areas larger than the typical lateral dimensions of the ion beam, and finally to machine aspheric surfaces. Concerning this matter, the etching behavior in the beam periphery plays a decisive role and has to be investigated. We use interferometry to characterize the final surface topography and XPS measurements to analyze the chemical composition of the modified surface after RIBE.

Keywords
RIBE
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XPS