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# THE FORMATION OF MICRONEEDLES STRUCTURES FROM SILICON USING PLASMA ETCHING IN $SF_6/O_2$ MIXTURE IN INDUCTIVELY COUPLED PLASMA

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**Abstract.** The study investigates a method for forming high aspect ratio microneedles structures from silicon using plasma etching at a sample temperature range from -20°C to +20°C in a $SF_6/O_2$ mixture. The resulting structures are an example of the self-formation of nanostructures due to anisotropic etching in a gas discharge plasma. The high aspect ratio microneedles structures from silicon, called black silicon, has high mechanical, chemical and thermal stability and can be used in wide range of applications, such as an anti-reflective coating: see Ayvazyan et al. 2021, photovoltaics: see Kroll et al. 2012, catalysts: see Fan et al. 2020. In this work surface morphology of the resulting structures, the autocorrelation function of surface features, and reflectivity were studied depending on the process parameters - the composition of the plasma mixture, temperature and other discharge parameters (radical concentrations). The change in the O/F concentration ratio of radicals explains the mechanism of needle formation. A novel approach has been studied to reduce the reflectance using conformal bilayer dielectric coatings deposited by atomic layer deposition. The reflectivity of the resulting black silicon was studied in a wide spectral range from 400-900 nm. As a result of the research, technologies for creating black silicon on silicon wafers with a diameter of 200 mm have been proposed, and the structure formation process takes no more than 5 minutes. Mean reflectance coefficient calculated in range 350-800 nm reaches <1%.

## References

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