

# NOHSO<sub>4</sub>/HF – A Novel Etching System for Crystalline Silicon

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Solutions consisting of HF – NOHSO<sub>4</sub> – H<sub>2</sub>SO<sub>4</sub> exhibit a strong reactivity towards crystalline silicon which is controlled by the concentrations of the reactive species HF and NO<sup>+</sup>. Selective isotropic and anisotropic wet chemical etching with these solutions allows to generate a wide range of silicon surface morphology patterns. Traces of Ag<sup>+</sup> ions stimulate the reactivity and lead to the formation of planarized (polished) silicon surfaces. Analyses of the silicon surface, the etching solution and the gas phase were performed with scanning electron microscopy (SEM), DR/FT-IR (diffusive reflection Fourier transform infra-red), FT-IR, Raman and NMR spectroscopy, respectively. It was found that the resulting silicon surface is hydrogen-terminated. The gas phase contains predominantly SiF<sub>4</sub>, NO and N<sub>2</sub>O. Furthermore, NH<sub>4</sub><sup>+</sup> is produced in solution. The study has confirmed the crucial role of nitrosyl ions for isotropic wet chemical etching processes. The novel etching system is proposed as an effective new way for selective surface texturing of multi- and monocrystalline silicon. A high etching bath service lifetime, besides a low contamination of the etching solution with reaction products, provides ecological and economical advantages for the semiconductor and solar industry.

*Key words:* Acidic Etching, Mono- and Multicrystalline Silicon, Nitrosyl Ion