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Parameter optimization for an ICP deep silicon etching system

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Abstract

The paper aims at investigating the parameter optimization of silicon micro- and nano-sized etching by an ICP-RIE (Inductive-Coupled-Plasma Reactive-Ion-Etching) system. The source power and the SF6 gas pressure are two main parameters that dominate etching. A pre-test is conducted to estimate the process window of the SF6 gas pressure at some given source powers. The process window is a parameter range in which the etching result is acceptable but may not be the best. In order to achieve excellent etching quality, the Taguchi experimental method is applied to evaluate parameters and find their optimum conditions. With the source power and SF6 gas pressure being set into the process window, four parameters, which are the substrate temperature, the bias power, the gas cycle time and the C4F8 gas flow rate, are evaluated and optimized for microand nano-sized etching. An impressive result, 200nm-diameter pillar array with the pitch of 400nm, is realized.