Application of Dual-Doped TMAH Silicon Etchant in the Fabrication of a Micromachined Aluminum Flexing Beam Actuator

John Garra, Sebastiano Brida¹, Lorenza Ferrario¹ and Makarand Paranjape*

Department of Physics, Georgetown University, Washington, D.C. 20057, USA
¹Istituto per la Ricerca Scientifica e Tecnologica (ITC-Irst), Trento, ITALY

(Received September 1, 2000; accepted December 1, 2000)

Key words: TMAH with additives, aluminum actuator, CMOS-compatible, magnetometer

One of the main goals of microelectromechanical system (MEMS) fabrication is microdevice integration with standard integrated circuit (IC) technologies, such as bipolar or the more prevalent complementary metal oxide semiconductor (CMOS) processes. To that end, it has been found that the anisotropic silicon etchant tetra-methyl ammonium-hydroxide (TMAH) can be effectively used in a post-processing step with CMOS-based fabrication by doping it with silicic acid to prevent the unwanted etching of exposed aluminum. Furthermore, the addition of ammonium persulfate to the TMAH/silicic acid solution enhances etch rate and surface quality. The final etching solution, called dual-doped TMAH, is CMOS-compatible, highly selective to silicon over aluminum, and can therefore allow an aluminum layer to be used as an etch mask. In this paper, we utilize dual-doped TMAH towards the fabrication of a microstructure made entirely of aluminum. A flexing beam microactuator suspended over a bulk micromachined silicon cavity is presented for use as a magnetometer.