Some features of the substrate surface planarization for products of micro- and nanosystem technologies

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The question of total planarization of substrates surfaces by chemical mechanical polishing for products of micro- and nanosystem technologies is considered in the present article. The distinguishing feature of planarization of substrates for microelectromechanical and nanoelectromechanical devices is that on the same work surface there can be elements with dimensions differing from each other for 2 (or more) orders. At the same time the initial microrelief of the most of the work surfaces is characterized by significant level difference; work surface can contain areas of different materials with differing physical, mechanical and chemical characteristics, and substrates are highly inclined to brittle rupture. While planarization it is necessary to provide effective smoothing of work surface microrelief with minimal allowance for processing.Theoretical investigation of chemical mechanical polishing is conducted. The factors which influence rate of work surface local wear are considered. Mathematical model to determine wear rate is offered, it takes into account factors and conditions of processing. Mathematical model to estimate integral wear rate for randomly selected point of substrate surface is designed. Methods to calculate distribution of wear rate along the work surface are developed. These methods allow taking into account distribution of abrasive medium rates, pressure, temperature, chemical activity of the environment, geometry of polishing pad surface. Calculation results for distribution of wear rate along the work surface for some processing modes are shown. The results of the calculating experiments allow to conclude that the planarization by chemical mechanical polishing can be effectively managed to improve the coefficient of planarization.

Keywords: *micro- and nanosystem technologies, substrate, chemical planarization, chemical mechanical polishing, abrasive wear.*

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