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Selection of optimal parameters in fabrication of poly (dimethylsiloxane) microfluidics using taguchi method

Abstract

The excellent performance and achievements by the microfluidics systems at fluid flow manipulation in the recent years have ignited the passion and interest of many researchers around the world, Since a microfluidic is required to handle a minimal amount of fluid at micron level, an optimum fabrication process is in inevitable. Thus, a research study was performed on a series of microfluidic fabrication samples in order to determine the controlled parameter affecting the fabrication process and bonding strength. The samples of Poly(dimethylsiloxane) and curing agent were carefully prepared in vacuum chamber and subsequently cured using a low temperature furnace. There are three level of temperature used for the curing; 65, 70 and 75 C and the samples were mixed in 80%, 85% and 90% Poly(dimethylsiloxane) and 20%, 15% and 10% curing agent, after obtaining controlled parameters and the degree of influence of individual parameters, a further validation of the predicted par arried by testing the bonding strength between PDMS and silicon substrate, the yield strength was measured while detaching the tensile-test specimen mechanically with a tensile tester. All the data has been interpreted using Taguchi's method to analyze the most contributions are recorded from the 75 C, 90% Poly(dimethylsiloxane) and 10% curing agent and the most influential parameter is found to be th e Poly (dimethylsiloxane) and for the verification, the samples were surface treatment by plasma oxida- tion and the tensile bonding strength were measured. The bonding strength test results prove that the optimal parameters obtained from the Taguchi numerical analysis remain the valid controlled significant factors.

Keywords

Fabrication; Optimal parameter; Poly(dimethylsiloxane) PDMS; Scanning electron microscope; Taguchi method