Grinding Characteristics and Process Parameter Study of Silicon Wafer

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ABSTRACT

Manufacturing of silicon wafers begins with growing silicon ingots and slicing these ingots into wafers by wire sawing. The sliced wafers have to go through many processes before they can be used for various applications. The surface grinding of silicon wafer is one of important processes used to flatten the wafers and to reduce the thickness of the wafer. As the diameter of the wafers becomes larger and larger, the sliced wafers become thicker and thicker. Surface grinding has become more important and has attracted more interest among investigators. Surface grinding can be divided into two steps, namely coarse grinding and fine grinding. In the coarse grinding, high feedrate is used to obtain high material removal rate. In the fine grinding, low federate is used to assure high surface quality. Among the grinding process parameters, wheel rotational speed, chuck rotational speed and federate are considered to have the surface flatness and roughness. It is also known that interactions between these process parameters exist for these quality characteristics. Widely used Taguchi experiment method uses partial factorial experiments to evaluate the main effects of the factors （parameters）and to identify the optimum settings of these factors. But Taguchi method is not adequate when there are strong interaction effects between factors. In this research, second-ordered Box-Benkhen experiment design is employed to reveal the main effects and the interaction effects of the process parameters of silicon wafer surface grinding. The process outputs studied include spindle motor current, chuck motor current, surface roughness and total thickness variation（TTV）of the wafer. The models that relate the process parameters with respect to fine grinding will then be determined by mathematical programming methods to increase the through put and quality of the silicon wafers.

Keywords : surface grinding of silicon wafer, grinding process parameters, factor interaction, Box-behnken experiment design, total thickness variation

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