Improvement of Lapping Machine Slurry Supplying System

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Abstract. Wafer lapping process affects product quality and competitiveness. Improving existing wafer lapping equipment, adding a automatically tuning system of slurry flow rate, wafer surface quality is improved, defective goods are decreased, and cost is saved.

Keywords: lapping machine, automatically, tuning system of slurry flow rate.

1 Introduction

Slurry plays a very important role in the lapping process of semiconductor wafer, crystal and all kinds of Rigid-fragile materials. For wafer surface, when slurry flow rate is increased, the ability of impurities removal is enhanced, wafer laps more sufficiently, wafer surface quality is better. But too high slurry flow rate will increase material cost and reduce product competitiveness.

With the high speed development of semiconductor industrial, the demand of material surface quality such as wafer becomes more and more critical. So far the best way to improve surface quality is to increase slurry flow rate during the fine lapping. Existing equipment applies manual control of slurry flow rate, but it can’t meet product acquirement. So the automatically tuning system of slurry flow rate is more and more attractive for lapping machine.

2 Improvement Plan

Background: Wafer lapping process consists of two sub-processes ----coarse lapping and fine lapping. Coarse lapping utilizes slurry to remove affected layer from slice process. Fine lapping improves surface quality by the way of increasing slurry flow rate. For existing lapping machine, operator manually adjusts slurry system to change flow rate to accomplish coarse and fine lapping, but this method depends on experience of operator, and operator couldn’t exactly control flow rate and time, so that wafer surface quality after lapping is unstable.

Method: After improvement, new slurry system can automatically adjust flow rate according to the two sub-processes. New system hardware consists of automatic level
control (ALC), programmable logic controller (PLC), touch panel and rotate speed control unit of peristaltic pump. ALC consists of industrial-computer, thickness meter and measurement probe. Measurement probe measures wafer thickness and compare with target thickness to generate Transistor-Transistor Logic (TTL) signal. PLC consists of digital input and relay output. Digital inputs receive TTL signal from ALC, PLC calculates and controls output signals.

Fig 1 shows main control unit of the new slurry system.

![Fig. 1. New slurry system main control circuit](image)

Two outputs of PLC connect to relay R1, R2; ALC’s output signal S1, S2 connect to input 1, 2 of PLC respectively.

Fig 2 shows the peristaltic pump’s control diagram of new slurry system.

Auxiliary normally open (NO) contact R1NO connects auxiliary normally closed (NC) contact R2NC, potentiometer T1 and analog input of peristaltic pump;

Auxiliary NO contact R2NO connects auxiliary NC contact R1NC, potentiometer T2 and analog input of peristaltic pump.

Peristaltic pump unit consists of pump rotation direction control switch and analog input which control rotation speed.

Used touch panel as man machine interface. RS 232 Communication is between touch panel and PLC. Fig3 shows the flow rate control interface of touch panel. There are two rotation speed selected buttons of peristaltic pump, which are Pump speed 1 and Pump speed 2.