Chapman Instruments

Wafer Edge Area Topography

Using the Chapman Non-Contact Profiling System

Introduction

Requirements for polished silicon wafer edge geometries are increasing as the industry moves to finer linewidths. These requirements are driven by the need to minimize particle contamination on the wafer surface. Even a few sub-micrometer particles can result in problems for wafer fabs. An unpolished wafer edge has a rough surface that can trap small particles which can then migrate to the wafer surface. Chapman Instruments non-contact surface profiling products have the unique capability of measuring the wafer edge surface, either on the bevel or crown. This application note shows a new feature of the Chapman system and software – very detailed area surface maps of the wafer edge surface. This expands on the production based systems that report an roughness number anywhere on the wafer edge, including inside the notch.

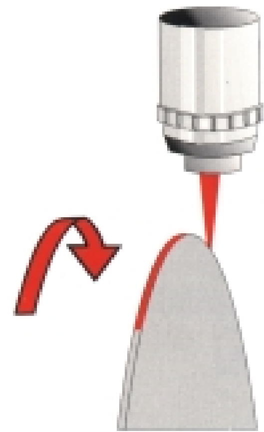

Fig. 1: The focused laser moves along the wafer edge; the wafer remains stationary during the measurement process.

Measurement

An example of the area measurement capability is described in this application note. The measurements were made on a 200 mm edge-polished silicon wafer using a Chapman Instruments MP3100 automated surface profiler. The system included automated wafer handling using a robot (available in either 150 mm, 200 mm, or 300 mm). The measurement set up included automatic loading and positioning of the wafer.

A set of two area measurements along the apex of the wafer edge is shown in Figure 2. The original measurements were 10 mm in length and 100 micrometers in width. Figure 2 shows a 400 µm section of each scan. Chapman's autofocus system guarantees that the laser will be in focus on the wafer edge surface. The measurement configuration is shown in Figure 1 with the focused laser moving along the wafer edge. This measurement can be made either in 2-D line geometry or 3-D area measurement.

Figure 2A shows a 400 µm section of the first area measurement along the wafer edge. The area map shows the view in the X direction from 0 to 400 µm and in the Y direction from 0 to 100 µm. The color bar at the bottom of the data shows the height of the surface topography data. The data shows that the surface is not uniformly smooth. Small circular features are evident on the surface, most likely from the effects of the edge polishing process. Also evident are very small pits on the surface. The overall surface structure shows a complicated

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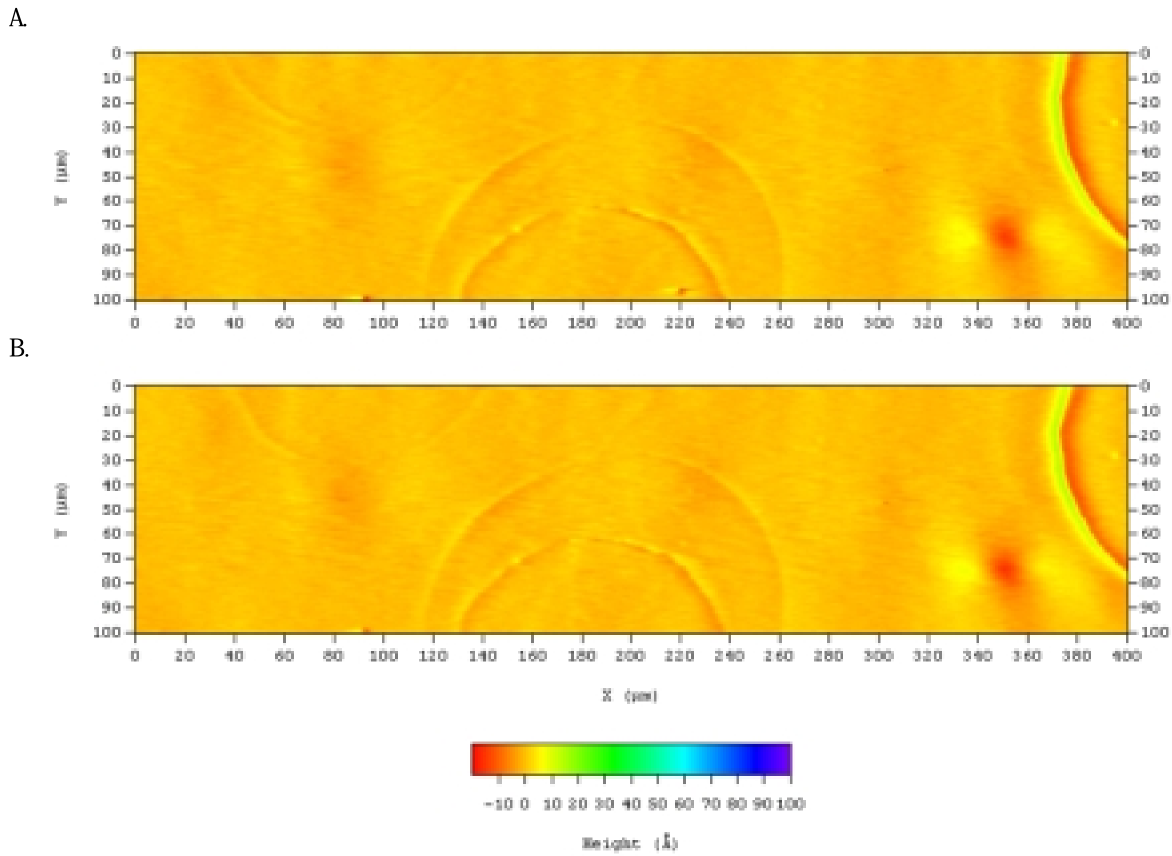

Fig. 2: Repeat area scans along a wafer edge. Actual scans were 10 mm in length. This figure shows a 400 µm section of the data.

pattern made up of small circular patterns and striations on the surface. Measurements such as the example in Figure 2 show interesting surface structure.

To ensure that the measurement reflects the actual surface, we show a repeat test in Figure 2B. The repeat test was made at the same location. Figure 2B shows this same repeat test with the same surface structure. This test ensures that the results are an accurate representation of the edge surface topography.