SPTS
An orbotech Company

APPLICATION
BRIEF

Plasma Dicing

Introduction

Wafer dicing is generally carried out using conventional blade technology. However this method has limitations which can be overcome by using dry plasma etching.

Blade cutting can cause die chipping or cracking leading to lower device yields. Also the necessary width of the blade removes valuable "real estate" from the wafer. Deep Reactive Ion Etching (DRIE) is a dry plasma process which can etch very narrow, deep vertical trenches into silicon (known as dicing "streets") to separate individual die.

Why Use Plasma Dicing?

- All dicing streets are etched simultaneously, resulting in throughputs at least 2 times greater than mechanical sawing
- Unlike sawing, plasma dicing will not damage the wafer surface or affect trench sidewall, resulting in greater die strengths, improved device reliability and increased device lifetime
- The narrower street widths of plasma dicing free up valuable wafer real estate allowing for increased die count on each wafer
- Non-rectangular die shapes can also be created (i.e. defined by mask, not blade cut) - see Fig 5 overleaf

Dicing Before Grind (DBG)

In the DBG approach, die are defined by partially etching the front side of a masked wafer up to a depth of approx 200µm. The wafer is then attached face-down to a dicing frame and the backside of the wafer ground away until singulation of the die occurs. Plasma dicing offers reduced cycle times and lower manufacturing costs when compared to conventional mechanical dicing. SPTS' Mosaic™ Rapier-S DRIE systems provide 2 times greater throughputs than mechanical sawing, and have already been qualified at customer sites for this application.

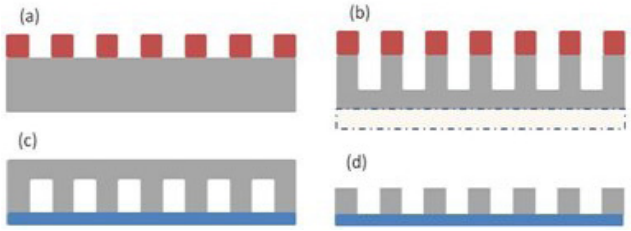

Fig. 1 Schematic diagram illlustrating Dicing Before Grind (DBG)

Dicing After Grind (DAG)

In the case of DAG, device wafers are thinned, then taped onto frames. The die are then singulated by etching through the complete silicon thickness, to the tape.

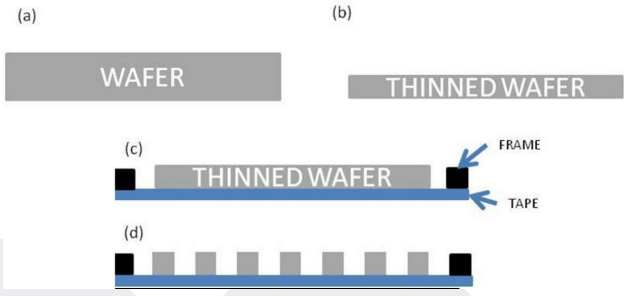

Fig. 2 Schematic diagram illlustrating Dicing After Grind (DAG)

SPTS has successfully demonstrated plasma dicing after grind, overcoming the challenges of process control, tape damage and vacuum handling of framed wafers after die singulation, not encountered in dicing before grind.

Dicing Before Grind (DBG)

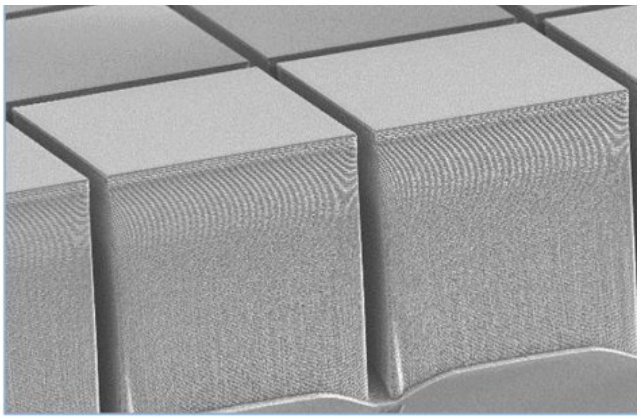

Fig. 4 Example of plasma dicing before grind

Dicing After Grind (DAG)

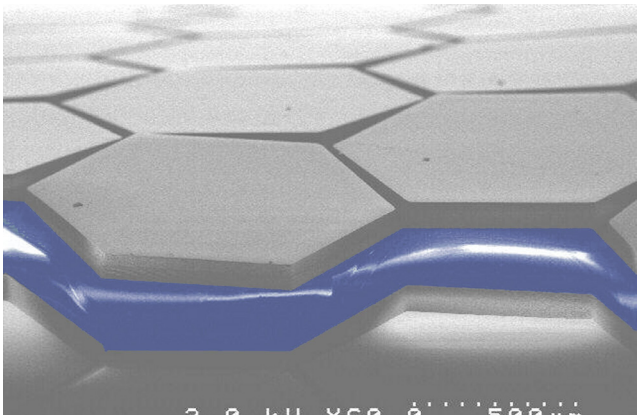

Fig. 5 Example of plasma dicing after grind, with underlying tape shades in blue

Mosaic™ *fx*P Rapier System

The SPTS system recommended for dicing after grind is Mosaic™ *fx*P with Rapier-S process module.

Key Features:

- Compatible with150mm - 300mm wafers on frames
- Frame compatible end effectors
- Up to 6 PM positions
- Alignment of wafer (on frame) for etch process repeatability

Sentinel™ End-Point Detection

The Sentinel™ end-point detection system (patent-pending) has been developed to improve the control of plasma dicing processes and protect taped wafers for improved yields. In addition to signaling exposure of the tape, Sentinel also detects loss of active cooling during the process to enable intervention to prevent yield loss.

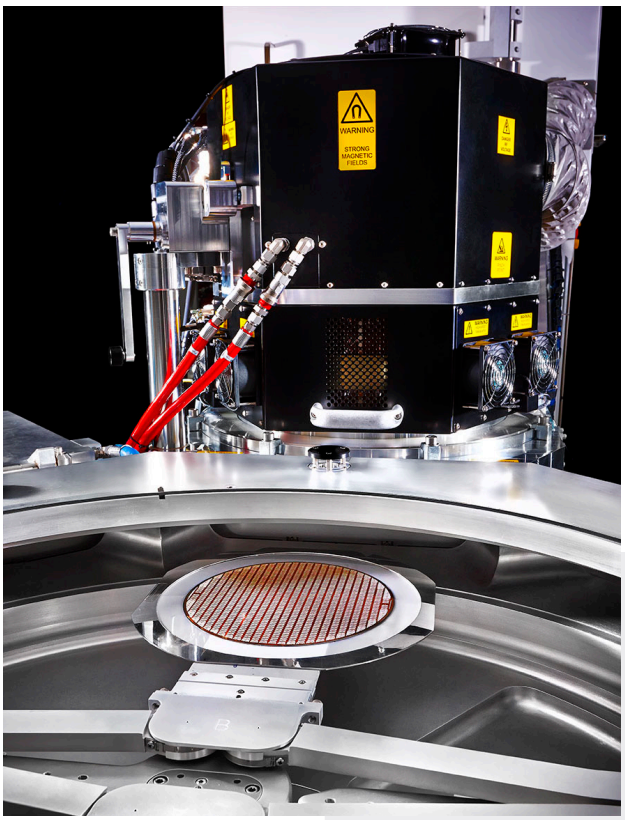

Fig. 6 Mosaic™ fxP Rapier-S plasma dicing system

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