The importance of low damage sample preparation for backside analysis

Introduction

With several new analysis techniques available for the failure analysis engineer's toolkit, it is becoming inceasingly more important to achieve better polished surface finishes through the lowest damage thinning and polishing methods. It is demonstrated here that **Selected Area Preparation (SAP)** improves upon high-speed milling machinery approaches, to yield an optimized sample.

Preventing Thermal Damage – an ounce of prevention is better than a pound of cure

Tabulated below are values gained during the processing of silicon substrates by both high speed milling and SAP methods.

Condition	Temperature Rise During Process
High speed milling -- Dry Grind	600 ^{O}C to 700 ^{O}C
High speed milling – Wet Grind	100 ^{O}C to 200 ^{O}C
SAP -- Dry Grind	20 ^{O}C to 40 ^{O}C
SAP -- Wet Grind	5 ^{O}C to 15 ^{O}C

Thus, **high speed milling** introduces excessive thermal energy that must be controlled by adding large amounts of coolant. Locally at the tool/substrate interface, however, it may not be possible to maintain adequate coolant flow – a potential risk of overheating aluminum metallizations on frontside circuitry.

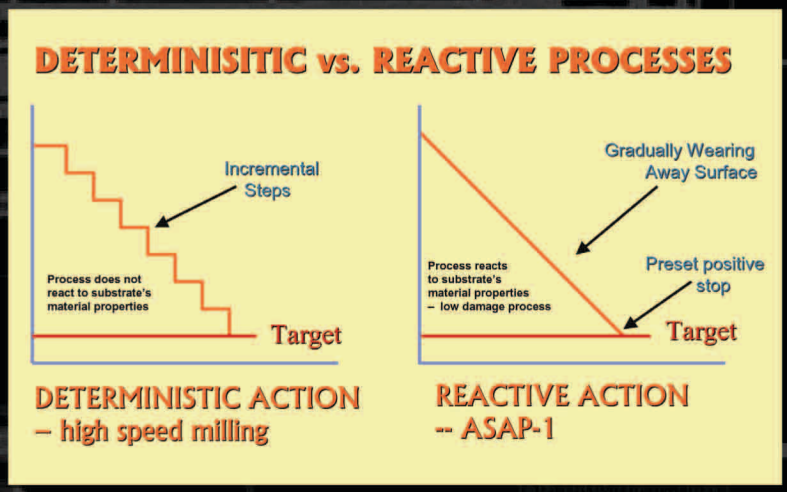
Conversely, under normal wet-grind conditions, it can be seen that **SAP** produces only very slight increases in temperature. This assures the user that no failures will occur due to grinding.

Even if **SAP** were used for dry-grinding (which is not recommended practice), it can be seen no significant temperature rise is seen. This evidence clearly shows that, where thermal damage is concerned, 'an ounce of prevention is better than a pound of cure'.

Deterministic vs. Reactive Processes

As illustrated below, it may be seen that **high speed milling** may be described as a ***'deterministic'*** process – that is, the feed rate is selected before processing and is not subject to variation during processing.

Conversely, **SAP**, the method used by ASAP-1, is achieved by setting the end-point and providing the correct pressure. This method may be referred to as ***'reactive'*** since it allows the mechanical properties of the substrate to dictate the actual process speed at any given moment – thus producing a much lower damage machining method.



Improving Polishing Results

Due to its low damage characteristics, **SAP** has many benefits, such as:

1. The die may be thinned further, thus improving the efficacy of the subsequent backside testing technique.

2. '*Difficult*' samples, such as 8" wafers, ceramic packages, wafer sections and flip-chips can be processed reproducibly, along with older designs such as QFP, LOC, DIP etc.

3. The polished surface produced is optimized, making the method uniquely 'future-proof' for newer, more exacting, analysis techniques such as *LIVA, TIVA, OBIC, SCOBIC, Schlieren* thermal imaging and other *laser microanalyses*.

4. Higher Yields, due to reduced component breakages during sample preparation.

To find out more about achieving low damage conditions in your sample preparations, please contact ULTRA TEC.

ULTRA TEC MANUFACTURING, INC.
Toll Free (US) : 1.877.542.0609
Tel: 1.714.542.0608 Fax: 1.714.542.0627
www.ultratecusa.com