MEMSLand

Cost Effective MEMS to Develop a Sustainable High Tech Business

Point-One

Pole of innovative technology on nanoelectronics and embedded systems

ALSI laser dicing

(WP3, 2d mechanical treatment)

Aim: Develop laser dicing process suited for the special needs of MEMS

- Thick Si wafer material (> 200 µm)
- Debris free dicing

Best suited separation technique

	Coating & cleaning possible	Debris free surface mandatory
Thin wafers	ALSI's multiple beam technology	Advanced Laser Induced Sub-surface Separation
Thick wafers	Longer pulses (optional: short pulse UV single pass dicing for high aspect ratio) Multiple beam laser scribe & break	Advanced Laser Induced Sub-surface Separation? Backside multiple beam laser scribe & break?

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Status of laser dicing

Laser dicing by means of material removal

- Process modified for dicing thick material (> 200 µm)

Advanced Laser Induced Sub-surface Separation

- Proof of principle successfully demonstrated

Next steps:

- Laser separation of BCs:
  - NXP RF MEMS antenna
  - NXP MEMS Oscillator
  - C2V Micro CG gas analyzer
  - Cavendish Non-volatile memory chip
- Determine key parameters & process window for ALISS

Approach

Main issues	Short term approach: (modified) conventional dicing	Medium term solution: ALISS
Wafer thickness 200 - 400 um	Multiple beam IR laser dicing / UV single pass laser dicing	Advanced laser induced sub-surface separation
Wafer thickness > 400 um	Multiple or single beam IR laser dicing / UV single pass laser dicing (alternative multiple beam laser scribe & break)	Multiple layer advanced laser induced sub-surface separation?
Thick wafer & narrow street	Short pulse single pass UV laser dicing (266 nm or 355 nm?)	Advanced laser induced sub-surface separation
No high pressure water cleaning allowed	• Water rinsing • No coating &cleaning, recast etching? • Alternative to PVA coating and chemical removal?	Advanced laser induced sub-surface separation
No coating & cleaning allowed	Dicing without surface protection --> surface contaminated with debris (for 10 W process contamination about +/- 300 um along kerf)	Advanced laser induced sub-surface separation
Contamination free, no coating & cleaning allowed	Backside laser scribe & break (what about taping?)	Advanced laser induced sub-surface separation

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Results

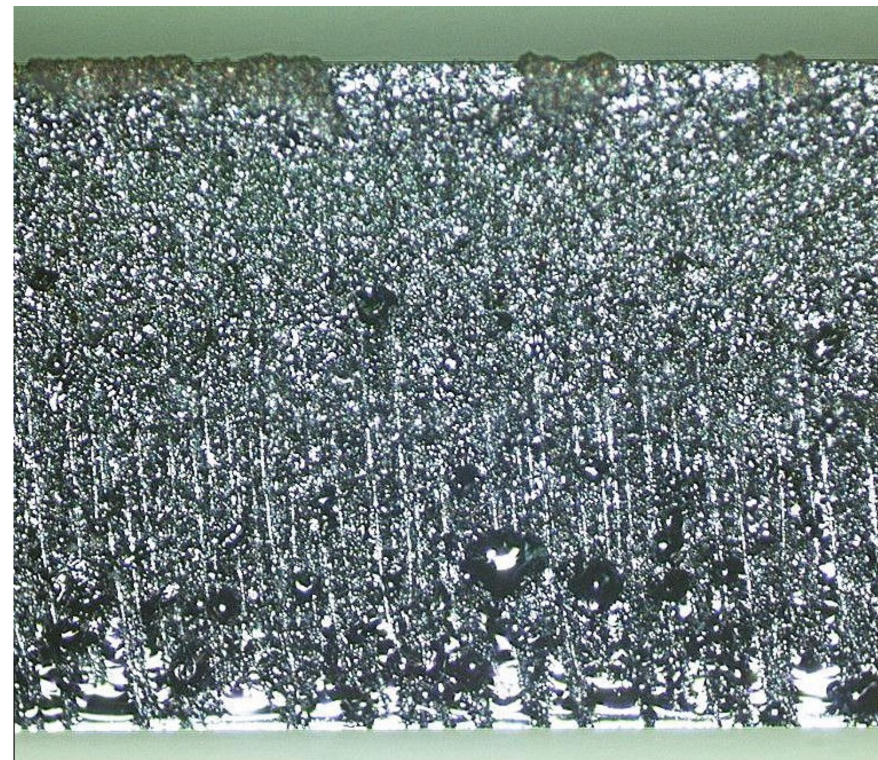
Conventional dicing

Multiple pass dicing through 400 µm Si

Top view

Single pass dicing through 730 µm Si

Side view



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Process description ALISS

(Advanced Laser induced sub-surface separation)

- Laser radiation transparent for target material
- Laser beam is focused with high numerical aperture lens
- Sub-surface modification along dicing vector due to absorption at the high intensity laser focus
- No surface modification
- Separation by means of subsequent breaking or expansion of dicing tape

Advantages:

- Contamination free separation (no coating & cleaning necessary)
- Zero kerf width, separation width depending on breaking behavior (crack propagation)
- High die strength (not important for thick wafers)

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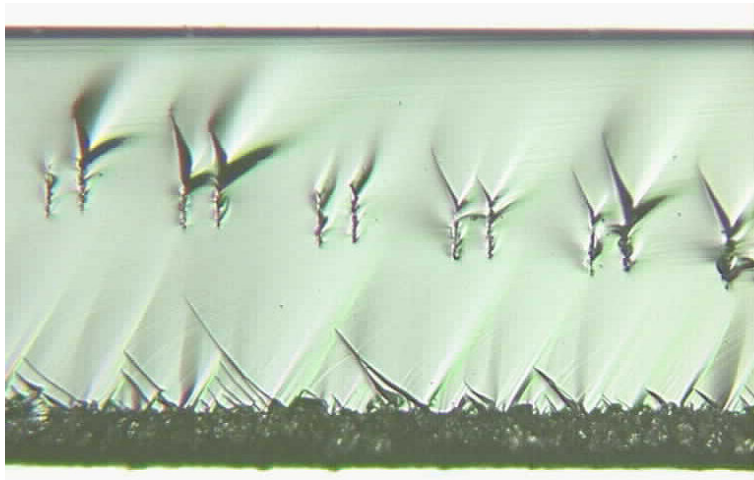
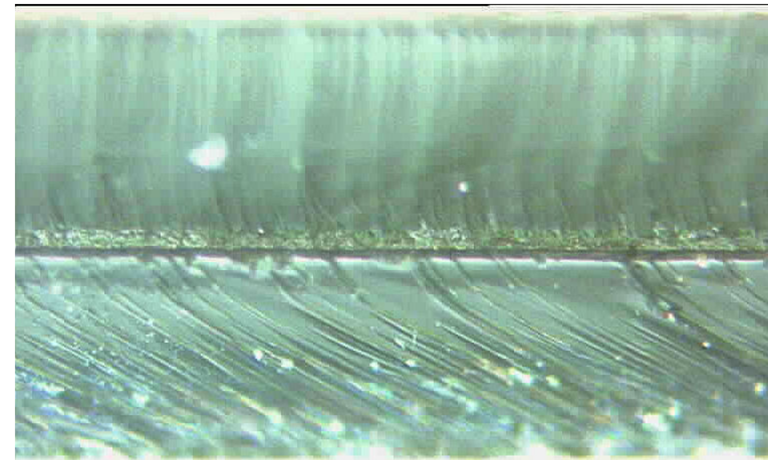
Results ALISS

(Advanced Laser induced sub-surface separation)



Crosse section perpendicular to modified tracks inside wafer



Longitudinal view to modified track inside wafer