VALTECH CORPORATION

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WHITE PAPER

VALTRON® TriAct™ Dicing Fluids

Executive Summary

Integrated circuits (IC) are produced on a silicon wafer and are sometimes called a chip or a microchip. A single wafer is designed to make multiple integrated circuit units through a dicing process of sawing the wafer. The dicing process can be done through diamond blade dicing or laser dicing.

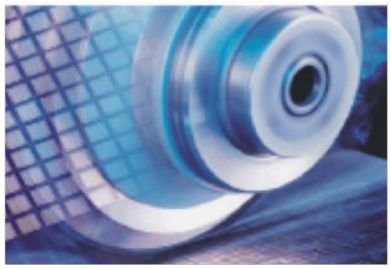

Fig. 1 Blade Dicing

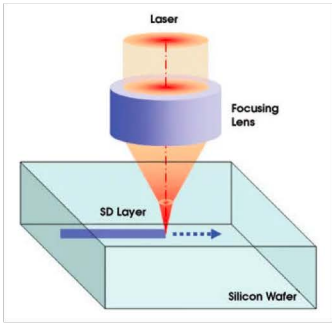

Fig. 2 Laser Dicing

The dicing process is accomplished by mechanical sawing the wafer in the extra areas between the die, referred to as either dicing streets or scribe lines. During the dicing process, small contamination residues or particles from dicing the silicon wafer adhere to the wafer surface and accumulate in bonding pads, trenched locations, and physical dicing blades. It is difficult to remove the residues in subsequent cleaning processes once they are in contact with the wafer and virtually impossible to remove once trapped in deep trenches. During the dicing process, the bonding pads and blades are exposed to corrosion. Corrosion shortens the blade life and damages the bonding pads, which leads to poor bonding performance, poor reliability, and even failure of the chips. Contamination and corrosion can cause problems later in the process, such as during the wire-bonding process.

It is important to use dicing fluids in the wafer dicing process in order to remove contamination, extend the life of the blade and improve chip quality.

Dicing Fluid Development Stages

The earliest dicing fluid was deionized water, which helped to lubricate the dicing streets by reducing friction, dissipating friction heat and reducing silicon particles adhering to the wafer surface. But water as a lubricant is not sufficient due to its high surface tension. Water is unable to prevent static charges, which leads to contamination accumulation.

Carbon dioxide gas is introduced into water as dicing fluid to increase conductivity and reduce static charge accumulation, which works as expected, but results in corrosion on aluminum blade and chips due to the acidity caused by carbon dioxide dissolved in water.

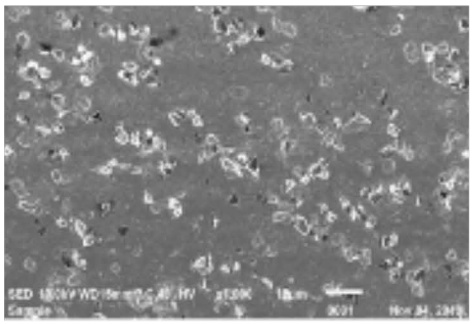

Fig. 3 Aluminum blade dicing with DI water with no signs of corrosion

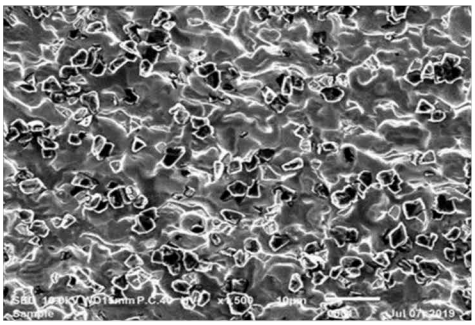

Fig. 4 Aluminum blade dicing with CO2 dissolved in DI water with signs of corrosion

Currently there are commercial chemical dicing fluids made of surfactants, metal corrosion inhibitors and other functional ingredients to provide better lubrication, silicon particle removal and to prevent metal corrosion on blade and chips.

VALTRON® TriAct™ dicing fluids are developed with pH neutral disinfectants in order to prevent the growth of microorganisms, such as bacteria and algae.

BEFORE *AFTER*

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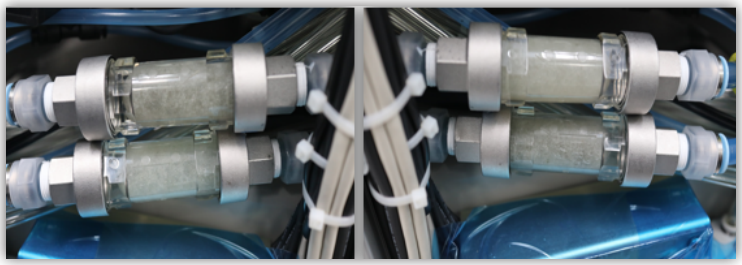

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VALTRON® TriAct™ Physical Properties and Application Performance

VALTRON® TriAct™ dicing fluids can be used for blade or laser dicing as well as on various substrates, such as metal, silicon, ceramic, plastic and more. They also provide various levels of anti-microbial function based on dilution rates. VALTRON® TriAct™ dicing fluids can be used with or without proper dilution with DI water depending on the specific product and application method as listed in Table 1.

Table 1: VALTRON® TriAct™ dicing fluids physical properties

Product	Dilution Rate	Key Actives	Performance Features	Cloud Point (°C)	Surface Tension (dyne/cm)		pH		Shaking Foam Volume
		Conc.	Diluted	Conc.	Conc.	Diluted	Conc.	Diluted	At Dilution
DF268	1:2000	1.0 x	Silicon Particle Suspension	34.5	31.5	39.9	7.0 ± 0.5	7.0 ± 0.5	27 ml initial 0 ml in 5 sec.
DF269	1:3000	1.5 x	Silicon Particle Suspension	35.0	30.0	47.8	7.0 ± 0.5	7.0 ± 0.5	30 ml initial 0 ml in 12 sec.
DF270	1:4000	2.0 x	Silicon Particle Suspension	33.0	31.1	50.0	7.0 ± 0.5	7.0 ± 0.5	26 ml initial 0 ml in 5 sec.
DF280	1:2000	1.0 x	+ Disinfection	33.5	31.5	41.3	7.0 ± 0.5	7.0 ± 0.5	27 ml initial 0 ml in 30 sec.
DF281	1:3000	1.5 x	+ Disinfection	38.5	31.1	49.3	7.0 ± 0.5	7.0 ± 0.5	30 ml initial 0 ml in 10 sec.
DF282	1:4000	2.0 x	+ Disinfection	33.5	31.4	49.8	7.0 ± 0.5	7.0 ± 0.5	27 ml initial 0 ml in 7 sec.
DF291	1:100	1.0 x	Ceramic particle suspension	52.0	33.5	35.5	9.0 ± 0.5	8.0 ± 0.5	30 ml initial 0 ml in 10 sec.
DF310	N/A	1.0 x	Laser dicing	> 50	32.5	N/A	3.0 to 6.0	N/A	N/A

Table 1 lists the physical chemistry properties of some typical VALTRON® TriAct™ dicing fluids. Table 2 exhibits some application performance of VALTRON® TriAct™ dicing fluids. Table 3 shows the antimicrobial efficacy of VALTRON® TriAct™ DF280 series.

Table 2: Application performance of VALTRON® TriAct™ dicing fluids in silicon wafer dicing

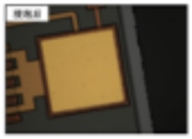
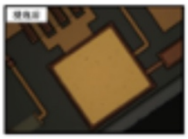
PERFORMANCE	DI WATER ONLY	TriAct™ DF268	COMMERCIAL PRODUCT
Silicon particles residue	Too much, failed	No particle residue	No particle residue
GaN wafer dicing qualities	Not tested	Pass rate: 99.90%	Pass rate: 99.83%
GaAs wafer corrosion test OM observation	Not tested	 No corrosion	 No corrosion

Table 3: Disinfection test results of VALTRON® TriAct™ DF280, DF281 and DF282

Dicing Fluid Products	Dilution Rate	Contact Time	Temperature	Staphylococcus aureus	Salmonella enteritidis	Pseudomonas aeruginosa
DF280	1:20	10 minutes	20°C	> 99.999%	> 99.999%	> 99.999%
DF281	1:30	10 minutes	20°C	> 99.999%	> 99.999%	> 99.999%
DF282	1:40	10 minutes	20°C	> 99.999%	> 99.999%	> 99.999%

Results and Conclusion

VALTRON® TriAct™ dicing fluids can offer the following advantages:

- Kills / removes microorganisms and slime algae
- Prevents die corrosion and lengthens diamond blade life
- Prevents particle / debris accumulation
- Replaces CO_2 and eliminates kerf loss
- Effective coolant with low foaming characteristics

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