Rinsing with ozon-included water

Basic test on pre-bonding

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DDS3 Manufacture Procedure

1 Precise machining of cells
2 Cell cleaning = Zone water rinsing
3 Stacking
4 Prebonding
5 Diffusion bonding
6 Some brazing
what is ozone water rinsing?

Purpose: to remove the carbone
Application example
Superconductivity cavity cleaning
RF window cleaning
Semiconductor manufacturing

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<th>Historical Review of Cell Surface Cleaning (OHI)</th>
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<td>DDS3D1</td>
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<td>DDS3D2</td>
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Cell rinsing procedure

(1) Inspection by eye

(2) Blow off the dust by nitrogen gas

(3) 16 cells are setted to teflon holder.

(4) Blow off the dust by nitrogen gas

(5) Acetone cleaning with ultrasonic wave to remove the machining oil 3 mins

(6) Blow off the acetone by nitrogen gas

(7) Pure water cleaning 1 minute 3 times

(8) Pure water cleaning with ultrasonic wave 3 mins

(9) Ozone water rinsing

15 minutes 3-4 [ppm]

(10) Pure water cleaning with ultrasonic wave 3 mins

(11) Blow off the water by nitrogen gas

(12) Soak cells in acetone 1 minute

(13) Soak cells in acetone 1 minute

(14) Blow off the acetone by nitrogen gas

(15) Inspection by eye
Ozone water rinsing system

- Water
- Oxygen cylinder
- Filter (0.5μm, activated carbon)
- Pure water line
- Ion exchange resin
- Filter (1μm)
- Buffer tank
- Ozone gas line
- Ozone water generation equipment

3—4 (PPM) 15 minutes
Rinsing process

(1) acetone
(2) pure water
(3) ozone water
(4) pure water
(5) acetone
Ozone water rinsing process

purpose: remove carbon
Concentration of ozone in pure water: 3 [ppm]
(1) There is no leak between diffusion bonding cells on which ozone water rinsing. We will be used next structure RDAF1.

(2) In future, many kinds of test of cell cleaning must be done. Then the cell cleaning procedure must be established.
What is preboinding?

Original idea and study ==> KEK Higashi
Purpose to prevent the cell from slipping

Feature
(1) Cell arrangement is maintained by pressing to V-block.
(2) Low temperature bonding
Prebonding Test

After Prebonding
1. Shearing Test
2. Bending Test
3. Bonding Surface Observation

Prebonding Condition
- Vacuum furnace
- Temperature: 150 °C
- Period: 48 h

Shearing Test
Bending Test
#2

Temperature: 150°C
Period: 10 [h]

Vacuum furnace was stopped by controller trouble

1. 17 kgf break
2. 17 kgf break
3. 20 kgf 5 k

Side cell came off
Shearing Test

#3

Temperature: 150°C
Period: 48 [h]

20 kgf OK

44 kgf Break

67 kgf Break

100 kgf OK

Shearing Test
「せん断試験」 試験片番号：No.2（9枚）
試験箇所：3（#16～#18の接合部剥離面）

写真 試験後の接合部剥離面外観
観察箇所

30kV X500  50μm  000010

同上拡大

30kV X2000  10μm  000011

「曲げ試験」 試験片番号：No.1（10枚）
試験箇所：①（#003〜#001）接合部剥離面
写真 剥離面のSEM観察結果
観察箇所

観察箇所：C

「せん断試験」 試験片番号：Nu. 2（9枚）
試験箇所：③（#16〜#18）接合部剥離面

写真 剥離面のSEM観察結果
Pre-bonding process

To make easier handling the structure when diffusion bonding, we adapt pre-bonding with v-block at low temperature.

vacuum furnace
temperature : 150 [°C]
period : 48 [h]
Consideration: the DDS3 Structure manufacturing process

- The pre-bonding process is very useful for easy handling the structure. But it needs more time and cost. To eliminate them, pre-bonding must be done at room temperature.

- There are a lot of processes using furnace. We would like to develop the technique joining all the components one time.