A Safe Solution to Dopant Gas Desorption from Metal Surfaces

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TAKACHIHO CHEMICAL INDUSTRIAL CO., LTD

Junction Technology Group
September 22, 2010
Takachiho: Origins and Timeline

Takachiho was established in 1948 and began operations in 1949
# What We Sell Today

## Takachiho’s Plants and Products

<table>
<thead>
<tr>
<th>Standard Gases Plant (Machida Campus)</th>
<th>High Purity Gases (HP-O₂, N₂, NO, Glass Ampoule High Purity Gases, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard Gases: (Takachiho Environmental Research and Reference Application Gas, Auto exhaust calibration gas, etc.)</td>
</tr>
<tr>
<td></td>
<td>Gas Mixtures: (Laser mixtures, lighting source mixtures, etc.)</td>
</tr>
<tr>
<td></td>
<td>disposable cylinder gases</td>
</tr>
</tbody>
</table>

| Semiconductor Gases Plant (Machida Campus) | HP-AsH₃, PH₃, BF₃, ion implantation gases, SDS® etc. |

| Gakuen Plant | Hydrocarbons, fluorocarbons, etc. |

| MO-CVD equipment, Sic-CVD equipment, ammonia exhaust gas neutralizer, regulators, emergency shut-off valves, etc. |
Client Spectrum

Our clientele reflects our mission—to make contributions to science through constant aspiration in expanding boundaries of technology.
What is Takachiho’s TOXICAPTURE™?

_ TOXICAPTURE™ is a micro-abatement system for very small amount of toxic gas._

_ TOXICAPTURE™ is a simple and easy solution to reduce:_
- risk towards human health
- risk of polluting clean room environment

_ TOXICAPTURE™ is used to further minimize trace toxic dopant gas inside cylinder valve outlets_

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Risk Concerns in Ion Implantation

- Use of high pressure gases
- Use of gases inside clean room
  (VS.outside in gas cabinets)
- Use of gases with extremely strong toxicity

ACGIH Threshold Limit Values:

<table>
<thead>
<tr>
<th></th>
<th>AsH3</th>
<th>PH3</th>
<th>BF3</th>
</tr>
</thead>
<tbody>
<tr>
<td>ppm</td>
<td>0.05</td>
<td>0.3</td>
<td>1</td>
</tr>
</tbody>
</table>

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Common Causes of Operator Exposure to Toxic Fumes

- Very slow leak from valve
- Valve loosening due to vibration during transportation
- Wrong operation on valve handle

✓ Toxicapture is effective for the following two!
  - Gas desorption from metal surfaces
  - Volatile chemical reaction occurring on metal surfaces

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RIKEN KEIKI SC-90 type
22: Cap Body
23: Gasket
24: Reagent
25: Barrier of Sintering Metal

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Problematic Outgassing Area

- Gas Connecting part
- Volume 1〜1.5ml
- SUS Body Material
- Diaphragm
- Spring
- Stem

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Prevention of dopant gas emission by simple chemical reaction--

- Non-poisonous reaction
- Irreversible reaction
- No Poissonous Metal
- No air or water reaction

TOXICAPTURE™ is Very Safe

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2010 in Semicon West
Proving TOXICAPTURE™’s Effectivity - Experiment at ATMI

Static test setup to evaluate the reaction kinetics involved

From ATMI’s Paper titled “Evaluation of Toxicapture™ Filter for BF₃ and PH₃ Removal” written by Paul J. Marganski, Research Engineer of ATMI MLS R&D.

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Reaction Capacity: 
970 \mu L \text{ (at 1 atm, 0°C)} = 43 \mu mol

Reaction Rate: 
51 \mu L/hr = 2.3 \mu mol/hr = 1.4 \times 10^{-5} \text{ cc/sec}

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From ATMI’s Paper titled “Evaluation of Toxicapture™ Filter for BF₃ and PH₃ Removal” written by Paul J. Marganski, Research Engineer of ATMI MLS R&D.

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- Enough capability to hold outgas from valve
- NOT enough to remove large amount of gas e.g. a full cylinder of gas

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Effective Gases & Types of Fittings

- Ion Implantation Gases: AsH\(_3\), PH\(_3\), BF\(_3\)
- Other Toxic Gases: CO, NO, SO\(_2\), HCl, Cl\(_2\), HF, H\(_2\)S, NH\(_3\), etc.
- Types of Fittings:

JIS type

CGA 330

CGA 350

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TOXICAPTURE™
Effective Gases & Types of Fittings

VCR _ Plug
VCR 1/4 Plug
VCR 1/2 Cup

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TOXICAPTURE™
Inside Implant Equipment Gas Box

MFC

Pressure gauge

Valves

Toxicapture

Cylinder

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United States Patent
Nakaneya et al.

Valve/Outlet cap for Toxic-Gas Container

Inventor: Tetsuomi Nakaneya, Machida (JP);
Makoto Inagaki, Machida (JP); Ryuta Tada, Machida (JP)

Assignee: Takachiho Chemical Industrial Co., Ltd., Yurigaoka (JP)

Patent No.: US 7,632,342 B2
Date of Patent: Dec. 15, 2009

Prior Publication Data

Related U.S. Application Data
Application No. 10/812,878 filed on Sep. 17, 2004

For a complete search of international patent data, see application file.

References Cited
U.S. Patent Documents

Claims, 2 Drawing Sheets
THE REGISTRY OF PATENTS
SINGAPORE

THE PATENTS ACT
(CHAPTER 21A)

CERTIFICATE OF GRANT OF PATENT

In accordance with section 11 of the Patents Act, it is hereby certified that a patent has been issued in respect of the invention specified in the following particulars:

Title: OUTLET CAP FOR TOXIC CONTAINERS VALVE
Application Number: 20040810.0
Date of Filing: 17 September 2004
Priority Date: 24 June 2004 - PATENT APPLICATION NO. 20040160 (JAPAN)
Name of Inventor(s): TAKACHIHO CHEMICAL INDUSTRIAL CO., LTD.
Name(s) and Address of Applicant(s) of Patent: TAKACHIHO CHEMICAL INDUSTRIAL CO., LTD., 2-1-11, UDHOGO CHOME, TAKACHIHO, MIYAZAKI, JAPAN
Date of Grant: 31 July 2009

[Signature]

Registrar

Takachiho Chemical Industrial Co., Ltd.

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China Patent
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Conclusion

Although minimized, use of toxic gas in ion implantation still contains risk of toxic fume exposure.

TOXICAPTURE™ can further minimize this risk thru a miniaturized gas abatement system placed in the outlet cap of a cylinder.

TOXICAPTURE™’s effectiveness was quantified—it has enough capability to hold outgas from valves.

TOXICAPTURE™ will help to maintain safe cylinder changes in ion implantation.

TOXICAPTURE™ in various forms may help to reduce: corrosion of gas supply system, hazard in work environment, vacuum operation time.

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Thank you for Your attention!

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