



TOXICAPTURE™

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# A Safe Solution to Dopant Gas Desorption from Metal Surfaces

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TAKACHIHO CHEMICAL INDUSTRIAL CO.,LTD



Takachiho Chemical  
Industrial Co., Ltd.

Junction Technology Group

September 22, 2010



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## Takachiho: Origins and Timeline



Takachiho was established in 1948 and began operations in 1949



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# What We Sell Today

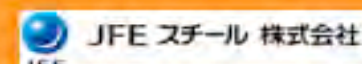
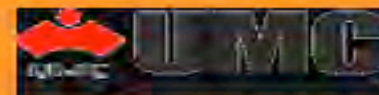
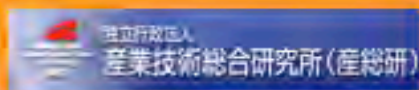
## Takachiho's Plants and Products

<b>Standard Gases Plant (Machida Campus)</b>	High Purity Gases (HP-O <sub>2</sub> , N <sub>2</sub> , NO, Glass Ampoule High Purity Gases, etc.) Standard Gases: (Takachiho Environmental Research and Reference Application Gas, Auto exhaust calibration gas, etc.) Gas Mixtures (Laser mixtures, lighting source mixtures, etc.) disposable cylinder gases
<b>Semiconductor Gases Plant (Machida Campus)</b>	HP-AsH <sub>3</sub> , PH <sub>3</sub> , BF <sub>3</sub> , ion implantation gases, SDS® etc.
<b>Gakuen Plant</b>	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





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## 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

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- \_ 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:

AsH <sub>3</sub>	PH <sub>3</sub>	BF <sub>3</sub>
0.05ppm	0.3ppm	1ppm



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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



# TOXIC GAS DETECTION

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RIKEN KEIKI SC-90 type

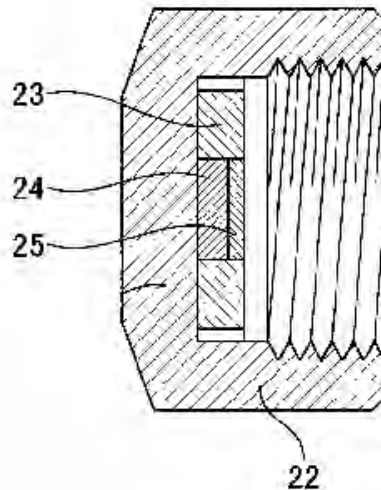


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# Takachiho's Solution- TOXICAPTURE™



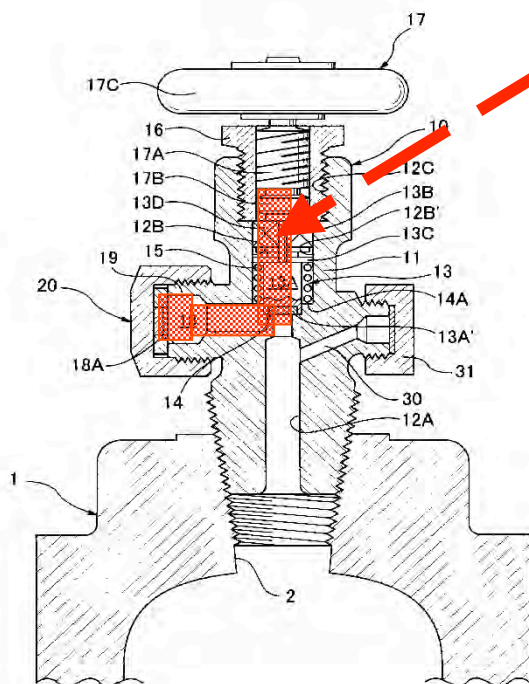
22: Cap Body

23: Gasket

24: Reagent

25: Barrier of Sintering Metal

# TOXICAPTURE™ & Valve Diagram



Problematic Outgassing Area

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

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# TOXICAPTURE™ is Very Safe

Prevention of dopant gas emission by simple chemical reaction--

- \_ Non-poisonous reaction
- \_ Irreversible reaction
- \_ No Poisonous Metal
- \_ No air or water reaction

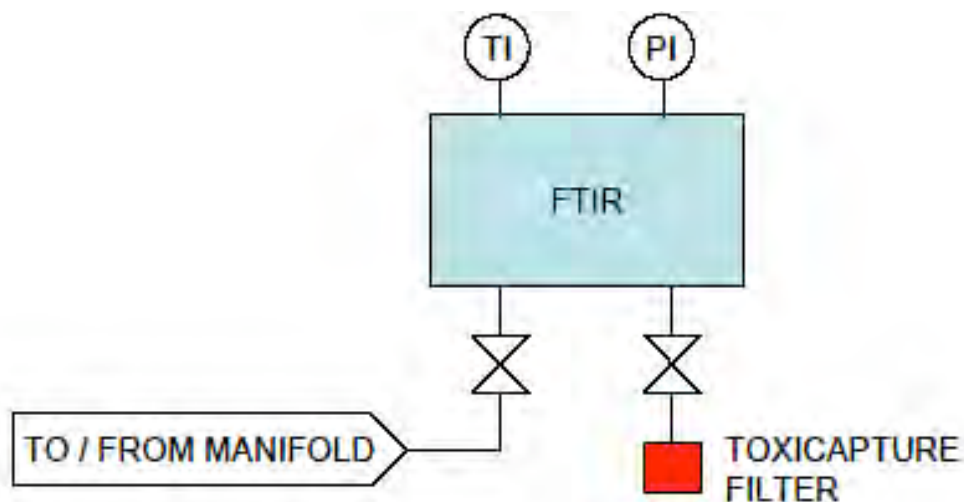


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# Proving TOXICAPTURE™'s Effectivity- Experiment at ATMI

Static test setup to evaluate the reaction kinetics involved

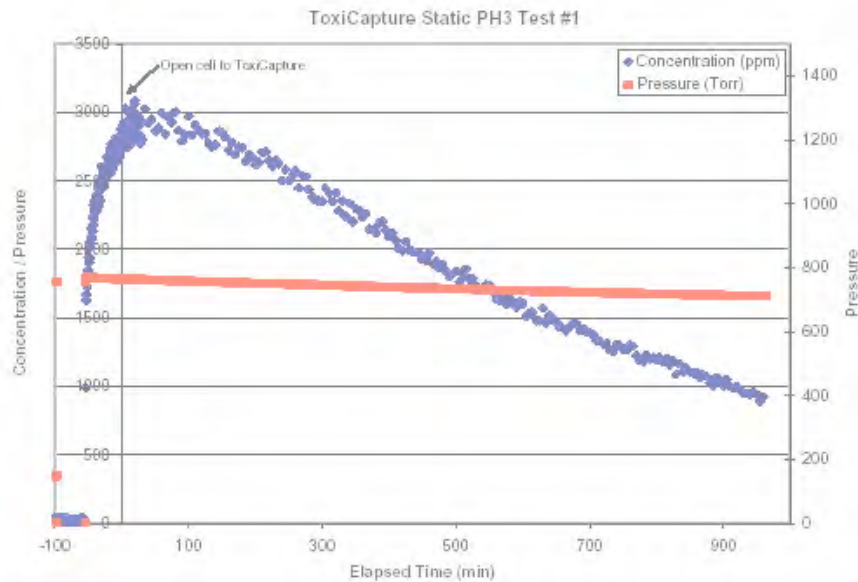


From ATMI's Paper titled "Evaluation of Toxicapture™ Filter for  $\text{BF}_3$  and  $\text{PH}_3$  Removal" written by Paul J. Marganski, Research Engineer of ATMI MLS R&D.



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## Experiment Results-PH3



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

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

From ATMI's Paper titled "Evaluation of Toxicapture™ Filter for  $\text{BF}_3$  and  $\text{PH}_3$  Removal" written by Paul J. Marganski, Research Engineer of ATMI MLS R&D.

- \_ 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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- Ion Implantation Gases: AsH<sub>3</sub>, PH<sub>3</sub>, BF<sub>3</sub>
- Other Toxic Gases: CO, NO, SO<sub>2</sub>, HCl, Cl<sub>2</sub>, HF, H<sub>2</sub>S, NH<sub>3</sub>, etc.
- Types of Fittings:



JIS type



CGA 330



CGA 350

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Effective Gases & Types of Fittings



VCR \_ Plug



VCR 1/4  
Plug



VCR 1/2  
Cup



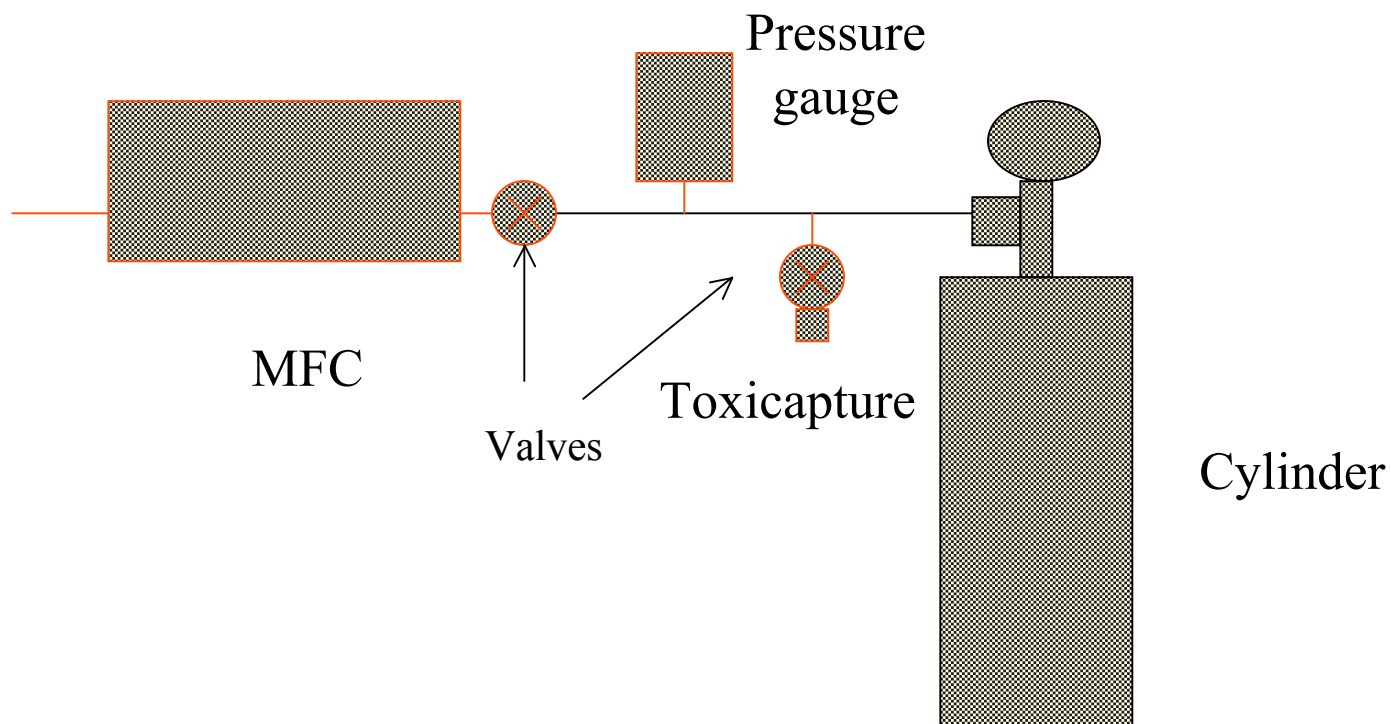
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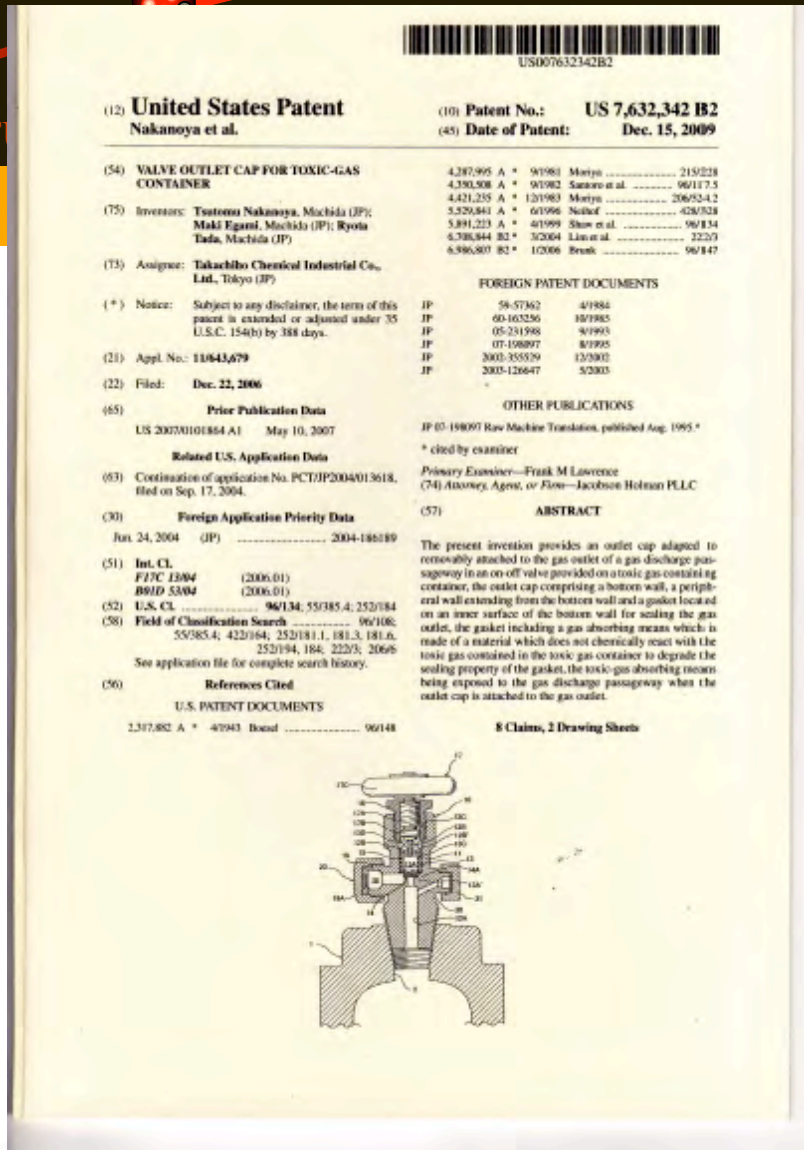
# TOXICAPTURE™ Inside Implant Equipment Gas Box





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# TOXICAPTURE™ PATENTS



## US Patent

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## Singapore 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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