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Patent(s) Issued

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Available Technologies

Fluorine Abatement: Non-thermal Plasma for the Destruction of Fluorine in Semiconductor Operations

SUMMARY

Fluorine containing gases (e.g. F₂, NF₃, SiF₄, CF₄, etc.) are environmental hazards and must be removed from emission sources to low levels. Fluorine, however, is marginally soluble in water and therefore cannot be efficiently scrubbed with water. A common approach to remove fluorine is to react the fluorine with hydrogen to form HF. This approach has two difficulties: the HF is highly corrosive at temperatures sufficient to initiate the reaction; and the reaction itself is highly exothermic requiring large cooling capacity.

Presented here is a water falling film non-thermal plasma reactor for the low temperature and highly efficient destruction of fluorine, developed specifically for the semiconductor industry. The non-thermal plasma generates F radicals in the gas phase, while also forming H and OH radicals. Recombination reactions form HF. The HF reaction exotherm is controlled by the water present, thus preventing significant increases in temperature. The newly formed HF is then removed downstream with a conventional scrubber.

A variation is to introduce hydrogen gas or hydride reducing agent, thus introducing H radicals into the radical chain and significantly reducing the energy requirements to form the reactive species.

A prototype device has been built and demonstrated on a semiconductor fabrication line.

ADVANTAGES

* Fluorine destruction without conversion to HF



Patents & Intellectual Property

- » Patent #: 6,962,672
- » Patent #: 7,160,521
- » Patent #: 7,220,396
- » Patent #: 7,407,635

Technology Portfolio(s)

- » Remediation
- » Chemical Processing and Catalysis

Potential Industry Applications

- » Chemicals

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