Waste Treatment by Atmospheric Pressure Plasmas

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- High enthalpy to enhance reaction kinetics
- High chemical reactivity
- Oxidation and reduction atmospheres
- Rapid quenching (10^6 K/s)

Atmospheric Plasma

- Low-Level Radioactive Waste
- Ion-Exchange Resin
- Municipal Waste
- Incinerated Ash
- Fly Ash from Melting Furnace
- Gasification

Indium Recovery from Liquid Crystal Panel by Non-Thermal Plasmas

- Removal rate at 79% from ITO panel was obtained by atmospheric plasmas using air within 1 min.
- Indium and Tin were removed simultaneously using atmospheric plasmas.

Voltage form of power supply for non-thermal plasma generation

XRD analysis

Color Filter Configuration
CFC, HFC, PFC Destruction by Water Plasmas

Mechanism
1. Arc generation
2. Heat conduction to water through copper anode
3. Plasma gas directly supplied from cooling water

Advantages
1. 100%-steam plasma generation
2. Portable light-weight plasma system
3. No additional water-cooling
4. No gas supply

Pressure: 101 kPa
Decomposition Time: 6 min
Arc Power: 0.65-1.47 kW
Arc Current: 4.0-7.0 A
Water Supply: 325 mmol/min
HFC134a: 5-185 mmol/min

Water plasma reactor for HFC, CFC destruction

Vehicle Mounted Water Plasma System for Waste Treatment

- Decomposition of HFC-134a was performed by water plasma system.
- Decomposition of 99.9% can be obtained up to 0.43 mmol/kJ (maximum feed rate is 160 g/h at 1 kW).

Plasma generation: air under 1-atom, Power: 220 kVA
CFC, HFC, PCB, Asbestos are possible waste material to be decomposed.

Conclusion
- Required research for attractive waste treatment
  - Reaction mechanism in the plasmas
  - Sophisticated numerical analysis (including chemical reactions)
  - Control of plasma reactivity
- There are numerous reactor designs for treatment of all types of wastes
- Economics is principal issue
- Economics improved if saleable co-product can be generated