

Decomposition and Removal of Effluent Freon-SF₆ Mixture by RF Plasma

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The efficiency of recovery achieved by open or closed loop extraction of RPC exhaust gases is in the range of 90% to 95% under optimum conditions. For a large detector setup operating on one volume change per day basis, a 5% loss amounts to discharging 50 kg of R134a and 0.5 kg of SF₆ into atmosphere every day. The emissions are equivalent to creating nearly 50,000 m³ of Carbon dioxide daily. Gas emissions need to be completely converted to safer compounds.

Gases such as R134a and SF₆ are stable compounds. In order to decompose them, the mixture is first activated by adding of 50% oxygen and 2% Argon and under typical RF plasma conditions of 13.56 MHz, 1 torr pressure and 0.2 Watt/cm² power density. The chemical reaction takes place on the surface of a Silicon electrode. Product of the reaction is mainly SiF₄ (gas), which is further hydrolyzed to form HF solution and Silicon Hydroxide sludge. More than 90% of effluent gas mixture can be effectively removed by this method.