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LASER PHOTOCHEMISTRY OF ClF IN GASEOUS PHASE AND CRYOGENIC SOLUTIONS

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The photochemistry of ClF has been studied both in the gas phase and in cryogenic solutions. Laser irradiations of gaseous ClF-SF_4 mixtures were achieved under isotopic selective conditions. Isotopic determinations were possible using Raman spectroscopy in cryogenic solutions. The observation of a branching ratio between processes yielding either SF_5Cl or S_2F_{10} and Cl_2, in addition to isotopic effects, has allowed us to propose a kinetic model. Related rate constants of the considered reactions have been evaluated, yielding a fair agreement between calculated and experimental results. The photochemical behavior of ClF under non selective cw laser irradiation has also been studied in the cryogenic solutions used for Raman detection. This allowed the observation of radical species, such as ClF_2, which exhibit a sufficient life-time for detection under such conditions.

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HIGH EFFICIENCY, PULSED HF CHEMICAL LASER USING A MIXTURE OF H_2 AND F_2 INITIATED BY AN INTENSE ELECTRON BEAM

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The stable gas mixing of H_2 and F_2 by adding a trace of O_2 at room temperature has been achieved. The electron beam (1 MeV, 20 kA, 70 nsec) initiated the HF pumping reactions by the dissociation of F_2 and/or H_2. The HF lasing has been obtained at a mixing ratio of $[F_2]/[O_2]/[F_2]=1/0.3/0.3$ and at total pressures up to 800 Torr. A typical HF laser energy was 180 J/pulse at an intrinsic laser efficiency as high as 200% and at a chemical efficiency (defined by the ratio of the HF laser energy to the total exothermicity of the pumping reactions between H_2 and F_2 as high as 8%.

The theoretical results of the detailed HF laser computer code involving dissociation reactions, pumping reactions, deactivation reaction and lasing reactions coincided with the experimental results.