Blumlein discharge initiated HF chemical laser

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Experimental results of the pulsed HF chemical laser are reported usiug Blumlein discharge initiated with non-corrosive SF_6 as fluorine source. Because SF_6 is an electronegative gas that attaches electrons easily, uniform glow discharge can not be easily obtained. Therefore, the following three measures have been taken:

1) Selecting lower ionized potential compound as hydrogen donor;
2) Using a more efficient uv-preionization to improve discharge conditions;
3) Reduceing main discharge circuit inductance to shorten pulse duration.

Discharge appeared in uniform glow in a SF_6/cyclo-C_6H_{12} mixture at a total pressure of 80 torr.

The experimental device is a nylon cylinder of 7.5 cm diameter, and 100 cm long. A pair of 70 cm long brass electrodes are fixed on the discharge cell with 2 cm spacing between the electrodes. The preionized sparkboard is made of 28 sparkgaps. The main discharge and preionization are charged by two seperate dc power supplies respectively. The resonator is made of a total reflecting aluminised mirror with 4m radius of curvature and a quartz flat. The hydrogen donor used were H_2, HCl, HBr, cyclo-C_6H_{12} and C_6H_4 $(H_3)_2$. Pulse energy was measured as a function of the type of hydrogen donor, its partial pressure as well as the total pressure. The maximum output energy was over 0.6 J with cyclo-C_6H_{12} as hydrogen donor in a $SF_6/C_6H_{12} = 1:15$ at a total pressure of 80 torr. Its specific output pulse and the electric efficiency are 20J/liter and 5% respectively. To our knowledge, 20J/liter is the best value of TE initiated pulse HF chemical lasers reported so far.

Blumlein 放电引发的 HF 激光器

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本文报导的是采用 Blumlein 放电引发的 HF 化学激光器的实验结果。采用无腐蚀性SF_6作为氟源。由于SF_6是电负性气体容易吸附电子不易获得均匀辉光放电，因此采取了以下三项措施：1)选用低电离电位的含氢化合物作为氢施主；2)采用紫外预电离以改善放电条件；3)减少回路电感以缩短放电持续时间。在SF_6/C_6H_{12}混合物中，总气压 80 托时，获得了均匀辉光放电。

实验装置是一长为 100 cm，直径 7.5 cm 的尼龙圆筒，一对长 70 cm，曲率半径为 0.1 cm 的黄铜电极，间距 2 cm，固定在圆筒壁上。紫外予电离由 28 个火花隙组成，主放电与予电离分别由两个直流电源供电。谐振腔由一全反射铝镜和石英平板构成。

采用了六种氢施主，测量了不同氢施主以及不同分压时的输出能量。当SF_6/C_6H_{12}=1:15，总气压 80 托时，最大脉冲能量超过 0.6 J。体能密度高达 20J/l，电效率为 5%。就我们所知，体能密度是迄今文献中所报导的最高数值。