Investigations on excimer lasers with various pumping schemes

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A working gas mixture of $NF_3 + Kr + Ar$ was transversely excited by an e-beam with initial energy of 0.3 MeV, a current density of 300 A/cm^2, a pulse width of 30 ns and window dimension of 1.4×9 cm^2. Laser output at 2484 Å was obtained as the total gas pressure varied from 460 to 2660 torr. Laser spectra, fluorescence spectra, laser output power and the central wavelength of the laser lines were studied as a function of the total and partial pressures. The effect of variation in gas mixing time on the laser output power of both laser and fluorescence spectra were compared with those of similar laser devices reported elsewhere.

Laser oscillations at 3511 Å and 3531 Å were obtained with a gas mixture of composition Ar: Xe: $NF_3 = 1000:3:1$ and a total pressure of 3.5 atm transversely pumped by the above mentioned e-beam apparatus. The effect of operating conditions on spectral line widths and angle of divergence were investigated.

It was discovered that HCl excelled BCl_3 as Cl donor in a transversely pumped KrCl excimer laser at 2220 Å.

In addition to higher e-beam utilization efficiency and better uniformity, coaxial e-beam pumping is very advantageous to dimer lasers, e. g. Xe_2^* laser, excited by three-body collision. As a 600 KV, 40 ns Marx generator was first used with an Ar-N_2 coaxial laser, 3577 Å and 3805 Å emission lines corresponding to $C^3\Pi_\mu$, $\nu' = 0 \rightarrow B^3\Pi g$, $\nu'' = 1,2$ transitions were obtained. Soon afterwards, Xe_2^* laser oscillation at 1730 Å was also realized using exactly the same device.

In the study of e-beam sustained discharge pumping, an e-beam apparatus of voltage 200 KV, current density 5 A/cm^2, pulsewidth 1 μs and window dimension 10×100 cm^2 and a 10–18 KV, 2.5 μf main discharge were used to excite an Ar/Xe/HCl gas mixture, XeCl laser output of 1 J, single pulse energy density of 0.5 J/l and a laser efficiency of 0.7% were abtained.

Fast-discharge high pressure XeF excimer lasers have been studied as well.

几种不同类型准分子激光器的研究

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用电子束初能为 0.3 MeV，电子束密度为 300A/cm² 脉宽为 30 ns，电子束窗口为 1.4×9 cm² 的高能电子束，去横向泵浦 NF_3、Kr_2 和 Ar 混合的工作气体，当总气压从 460 托到 2660 托变化时，均获得 2484 Å 的激光输出、并研究了其激光谱线、荧光谱线、激光功率、激光光斑和中心波长随气压及分压比之关系。也研究了气体混合时间对出光之影响，并在输出阈值、输出功率、激光谱线和荧光谱线方面与国外同类型器件进行了比较。

用上述高能电子束横向泵浦 NF_3，Xe_2 和 Ar_2 混合气体，当混合比为 $Ar:Xe:NF_3=1000:3:1$，总气压为 3.5 大气压时，得到波长为 3511 Å 和 3531 Å 的激光振荡。对其谱线宽度、光斑、气体成份和发散角等进行了研究。

在研究横向电子束泵浦 KrCl 准分子激光器时（2220 Å），发现用 HCl 作施主比 BCl_3 更为优越。

同轴电子束泵浦具有电子束利用率较高，均匀性较好，并适用于利用三体碰撞激发的同核型准分子激光器（例如 Xe_2 等）之优点。我们用 600 KV，40 ns，的 Marx 发生器，首先对 Ar-N_2 同轴激光器进行泵浦，获得 3577 Å°和 3805 Å°（$C^3\Pi_\mu$ $\nu'=0\longrightarrow B\Pi g$ $\nu''=1$，2）的激光辐射，用同样设备获得 Xe^*_2 1730 Å 的激光振荡。

用电压为 200 KV，电子束流密度为 5A/cm²，脉宽 1 μs，电子束尺寸为 10×100 cm² 的电子束，以及用主放电电压为 10–18 KV，主放电电容为 2.5 μf 的设备，采用电子束维持放电的激发方式，激发 Ar/Xe_2/HCl 混合气体，达到 1 焦耳 XeCl（3080 Å）的激光输出。激光能量密度为 0.5J/l，激光效率约为 0.7%。

对高气压快放电 XeF 准分子激光器也进行了研究。