Long-lived, sealed-off metal vapor lasers

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In many applications of interest, it would be advantageous to use a completely portable metal vapor laser. This would require a sealed-off laser discharge tube capable of containing the discharge at high temperature (~ 1000 °C) with a high degree of reliability. We have studied the problem of obtaining long-lived operation and have determined that a reliable quartz-molybdenum seal gives at least several hundreds of hours of operational lifetime in a self-heated sealed-off condition.

Parametric studies are reported for long-lived sealed-off copper halide and pure lead lasers operating at average output power levels of 6 W for CuBr lasers and 1 W for Pb lasers. Laser operating characteristics have been measured as a function of buffer gas species and pressure, temperature and pulse repetition rate. Optimum perforemance for a CuBr laser of 50 cm × 1.8 cm diameter longitudinal discharge was obtained with 10 Torr Ne, at 530 °C, operating at a prf of 16 KHz. Lead laser tests were performed in a 1.2 cm × 100 cm discharge tube. The optimum laser performance occurred at 1050 °C with 10 Torr of Ne. The maximum lead laser energy output per pulse is at ~ 1 KHz while the maximum power output is at 6 KHz. Both these lasers have operated over one hundred hours without significant degradation. Based upon these demonstrated performances we can project practical sealed-off metal vapor laser devices operating over 10 W with lifetimes exceeding 1000 hours.

长寿命密封式金属蒸气激光器

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在许多重要应用中，采用完全携带式的金属蒸气激光器将是有益的。这就需要有一个能够进行高度可靠的、高温（~1000°C）放电的密封式激光放电管。我们已经研究了获得长时间运转的问题，确定可靠的石英-钼封结在自加热密封条件下至少具有几百小时的运转寿命。

关于长寿命密封式铜卤化物及纯铅激光器，报导了它们的参数研究，CuBr 激光器的平均输出功率水平为 6 瓦，Pb 激光器为 1 瓦。已测得激光器的运转特性与缓冲气体种类、温度及脉冲重复率的函数关系。获得了50厘米×1.8 厘米直径纵向放电的 CuBr 激光器的最佳性能，此时，氖压为10托，温度为530°C，脉冲重复频率为16千赫。用一根1.2厘米×100厘米的放电管进行了铅激光器的试验。激光器最佳性能是在1050°C及氖压为10托时获得的。在~1千赫时，铅激光器每个脉冲的能量输出为最大，而最大功率输出在 6 千赫时获得。这两种激光器运转已超过100小时而无明显劣化。根据这些实验性能，我们可以设计寿命超过1000小时的10瓦以上的实用密封式金属蒸气激光器件。