brought to you by CORE

NASA TECH BRIEF

NASA Pasadena Office



NASA Tech Briefs announce new technology derived from the U.S. space program. They are issued to encourage commercial application. Tech Briefs are available on a subscription basis from the National Technical Information Service, Springfield, Virginia 22151. Requests for individual copies or questions relating to the Tech Brief program may be directed to the Technology Utilization Office, NASA, Code KT, Washington, D.C. 20546.

Double-Discharge Copper-Vapor Laser

The problem:

Recently, copper-vapor lasers have been shown to have potentially high power and efficiency in the visible spectrum. However, their typical operating temperatures are around 1,500° C, which makes them difficult to use.

The solution:

Two consecutive timed discharges have been used to produce lasing in copper chloride at 400° C.

How it's done:

A version of the copper chloride laser is shown in Figure 1. The power supply for the discharge pulses consists of two capacitors that are made to discharge synchronously with adjustable time intervals. The first pulse is switched with a hydrogen thyratron, and the second by a spark gap.

Studies on the effects of discharge time delay and the effects of temperature in copper-vapor lasers have shown that lasing action peaks for the appropriate

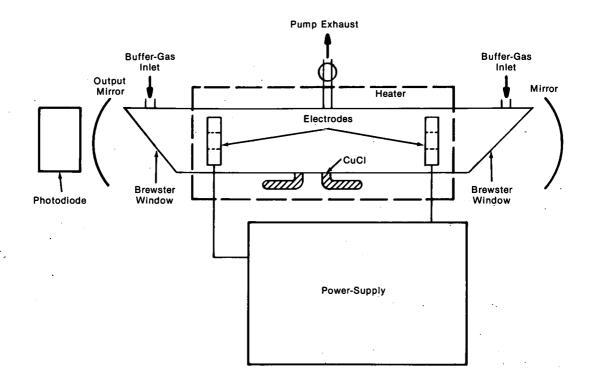


Figure 1. Schematic Diagram of a Copper-Chloride Laser

(continued overleaf)

This document was prepared under the sponsorship of the National Aeronautics and Space Administration. Neither the United States Government nor any person acting on behalf of the United States Government assumes any liability resulting from the use of the information contained in this document, or warrants that such use will be free from privately owned rights.

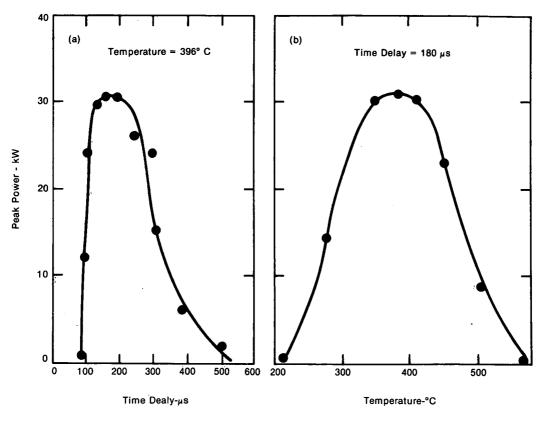


Figure 2. Dependence of Laser Peak Power on (a) Time Delay Between Pulses and (b) Temperature

combination of these two parameters. The results of one experimental measurement of these parameters are shown in Figure 2. At low temperatures, the vapor pressure is too low to provide enough copper atoms for lasing. The reason for the high-temperature limit is not clear, but the higher number density of the copper chloride vapor may lower the electron temperature and thus decrease the rate of excitation. The lower limit of time delay may represent the time required for the copper to relax to the point where it is possible to produce a population inversion with a second discharge. The upper time-delay limit is thought to be due to chemical recombination of the copper chloride.

Note:

Requests for further information may be directed to:

Technology Utilization Officer NASA Pasadena Office 4800 Oak Grove Drive Pasadena, California 91103 Reference: TSP75-10123

Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

> Patent Counsel NASA Pasadena Office 4800 Oak Grove Drive Pasadena, California 91103

Source: Che J. Chen, Nobel M. Merheim, and Gary R. Russell of Caltech/JPL under contract to NASA Pasadena Office (NPO-13448)