CC/NUMBER 34
AUGUST 25, 1980

This Week's Citation Classic

Laflamme A K. Double discharge excitation for atmospheric pressure CO_2 lasers. *Rev. Sci. Instr.* **41**:1578-81, 1970. [Defence Res. Estab., Valcartier, Quebec, Canada]

The 'double discharge' technique is used to produce large volume electrical discharges in gases at near atmospheric pressure for the excitation of TEA lasers. A weak, but well distributed preliminary discharge conditions the medium for a subsequent high energy discharge. [The *SCI*® indicates that this paper has been cited over 105 times since 1970.]

Albert Laflamme
Defence Research Establishment
Valcartier, Quebec GOA 1RO
Canada

July 16, 1980

"For 15 years before this paper was written I had been working at the Defence Research Establishment, Valcartier, as an instrument engineer in upper atmospheric research. It was quite a change to become involved in the development of transversely excited atmospheric pressure (TEA) CO_2 lasers.

"One of the pressing problems was to find a way to excite a large volume of the laser gas by means of a well distributed electrical discharge, which would not degenerate rapidly into a few bright arcs, in spite of the relatively high pressure of the gas. The only technique currently available then was to use a large number of pin-type electrodes, usually fed through current-limiting elements. The multiple 'column' discharges thus created were inherently stable but produced a medium of poor optical quality.

"I proceeded to experiment with a variety of electrode shapes and driving circuits in a simple 2-electrode configuration but without success. However, in the haste of testing new geometries, I occasionally masked part of the electrodes with common electrical tape or other insulating materials, and eventually noticed that I often obtained beautifully diffused discharges on the dielectric, much easier than on the metallic surfaces. I tried with one of the two electrodes completely covered with dielectric but breakdown of the material severely limited the energy which could be dumped into the medium.

"At this point, I was struck with a simple idea (at least in retrospect): instead of relying upon a few naturally occurring charged particles to initiate the discharge, I would use a weak, but uniform, discharge on a dielectric to abundantly 'seed' the gas volume, and then strike a more powerful discharge between metal electrodes. Since a metallic grid electrode was made common to both discharge circuits, the 'double discharge' laser became a 3-electrode system, which drew some comments to the effect that I had reinvented the triode. But in any case the idea worked fine, was patented and a brief description published immediately.

"I hesitate to comment on the reasons for the frequent citation of this paper because for the last few years I have been only loosely connected with this field. I presume that the major factor was the timely publication of a solution to a problem, which, at the time, interested many workers in a rapidly expanding field. Numerous variations of my original configuration (many of which were developed independently) as well as other techniques, such as UV pre-ionisation and e-beam excitation, were reported soon after.

"I may add that I was surprised and gratified to learn of this paper's frequent citation. I consider your unexpected invitation to prepare a *'Citation Classic'* to be a most valuable reward in itself."