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HIGH INTENSITY NANOSECOND STANDARD LIGHT SOURCE

Heinz FISCHER

Applied Physics, Technische Hochschule Darmstadt, 6100 Darmstadt, Fed. Rep. of Germany

The "Nanolite" represents an inexpensive nanosecond standard light source extending from the near uv to the infrared spectral range. Position stability of the spark channel, reproduceable light amplitudes and constant pulse shapes offer a variety of applications.

1. Introduction

The "Nanolite" produces max light output by a < 2 nHy matched circuit. The capacitor is plated on a metal tube. Capacities are varied between 400 - 3000 pF by changing the length of the plating. All "Nanolites" have the same gap geometry and related current rise, and were not changed over 10 years.

2. Design and Experiments

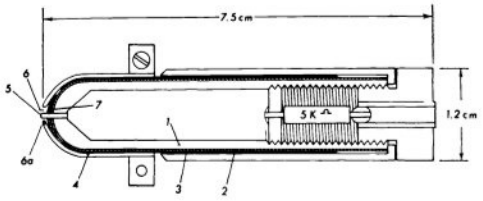

Fig. 1 Design of the "NANOLITE" (1).

Fig. 1 shows the design of the "Nanolite" - gap length and gas environment (up to 30 at) can be varied. The source may run with ∿ 20 cycles over any length of time. Short bursts exceeding 10^4/s are applicable - Trigger jitters are reduced to ≲ 1 ns, when the source is pulse charged. - Breakdown voltages, spark channel positions, light amplitudes and light pulses reproduce within a few percent under these conditions.

Fig. 2 Position stability of the spark channel (2).

Fig. 2 demonstrates the position stability of the spark channel in case of a 690 pF source - 4.3 kV, 1 mm gap in 1 at air. - 3 single shots are to the left, 60 shots are superimposed to the right. The filament diameter is approx. 0,1 mm.

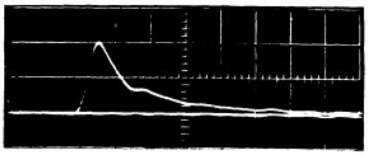

Fig. 3 Constancy of successive light pulses (2).

In Fig. 3, we recognize the constancy of successive light pulses. - 40 shots are superimposed, time resolution is 10 ns per division. The decaying light pulse is exponential and clean. Apparent bumps in the scope trace are due to electric reflexions in the detector system.

Light pulses of the "Nanolite" vary between ∿ 100 to 4 ns depending upon capacity and gas environment. - Continuous black body emission from 40 - 60.000 degree K is observed in the ∿ 300 - 650 nm range (3). - Max spectral radiances are up to 74 W cm^{-2} A^{-1} at 485 nm. The source emission was calibrated by a dc - carbon arc. Light-signals of comparing amplitudes and time length were produced by a 20 ns Kerr cell shutter and absorption filters, -

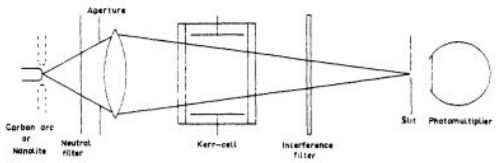

Fig. 4 Calibration-arrangement (3).

3. Applications

The source is widely used in ns photography, also kinematography.

Small < 1 nF "Nanolites" with polished electrodes, represent an inexpensive Standard-Light-source covering the wide spectral range from ∿ 230 to > 2000 nm. A short gap reduces the pulse-energy and stabilizes the filament position - the < 10 ns current pulse, without overswing, minimizes the electrode erosion (4).

Light amplitudes and pulsshapes reproduce within ≷ 2 % and suggest application in flash photolysis, after curve-matching.

< 2 ns risetimes of current and radiation are suited for trigger pulses and circuit response testing.

Short distance precision pulse-ranging is demonstrated in Fig. 5.

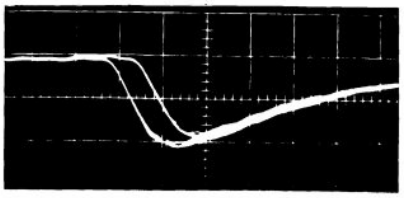

Fig. 5 Reflections from a target in 20 and 20,9 m distance (5).

The ∿ 30 % reflexion, grey target was 55 by 75 cm, time scale 10 ns/cm, 40 shots are superimposed. - A ranging accuracy of few centimeters is confirmed by the narrow trace width.

The "Nanolite" geometry was used to pump a nitrogen-laser cavity. Threshold was a low 3,3 kV and increased laser power of ∿ 140 kW at 3371 nm was obtained in case of a 18 kV pulsvoltage; the energy input was only 240 mJ in this case (6).

The new "Nanolite" with water cooling, see Fig. 6, will give long pulse series with increased repetition rate.

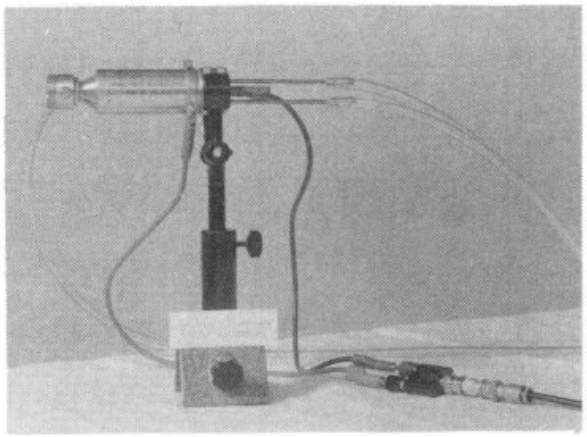

Fig. 6 Photography of water cooled "Nanolite" with pressure cap.

Acknowledgment

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Supplier for the "Nanolite" is "Impulsphysik GmbH" in Hamburg, Germany.

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