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# Flat Dielectric Barrier Discharge Lamp in Interaction with a Resonant Power Supply

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## Introduction

Dielectric Barrier Discharge (DBD) lamps have a lot of applications in industry and research (lighting, surface treatment, etc.), so the knowledge of their behavior and their parameters are essential. A DBD lamp is generally composed of 2 dielectric layers, separated by a gas mixture [1]. Plasma will appear in the gas when the  $v_{gas}$  voltage reaches the  $V_{th}$  threshold.



The purpose of this study is to analyze the interaction between a pulsed current power supply [2] and a flat DBD lamp.

## Material and methods

Dielectric thickness : 3.15mm  
GAP : 2 mm  
Gas : Ne-Xe 50% 400 mBar  
Area : 60x60 cm

The Power Supply operates on a resonance principle

power source = fixed part of the power supply + coil to be adapted

Dielectric barrier discharge part = Characteristics to be determined

Electrical transformer = part to be adapted

### Manley Diagram

AB and CD: capacitive phases **plasma off**.  
The slope of AB indicates the capacity value  $C_{eq}$ .  
 $C=C_{eq} = \frac{C_{diel} + C_{gaz}}{C_{diel} + C_{gaz}}$

BC and DA: discharge phases **plasma on**.  
The slope of BC indicates the capacity value  $C_d$ .  
 $C=C_d$

Matlab

Experimental Current

## Results and discussion

### 20kHz to 80kHz

Series of measurements by setting the input voltage amplitude to 150V and varying the frequency from 20kHz to 80kHz

### Capacity

Capacités en fonction de la fréquence imposée

### Vth

### PManley et Pnoy (40kHz)

### PManley et Pnoy (50kHz)

Power + Luminance measurements

### 40kHz

### 45kHz

### 50kHz

### 55kHz

### 30 to 180V

Series of measurements by setting the frequency to 60kHz and varying the amplitude of the input voltage from 30 to 180V.

### Capacity

Capacités en fonction de la tension d'entrée

### Vth

### n=3

### n=4.5

### Inductance

## Conclusion and perspectives

Theoretical formulas make it possible to determine in advance the voltage, current and power amplitudes.

Maximum efficiency of 18 lum/Watts achieved.

An additional optical study will have to be carried out by modifying the inductance value.

## References

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