Experimental investigation of low power microwave microplasma source

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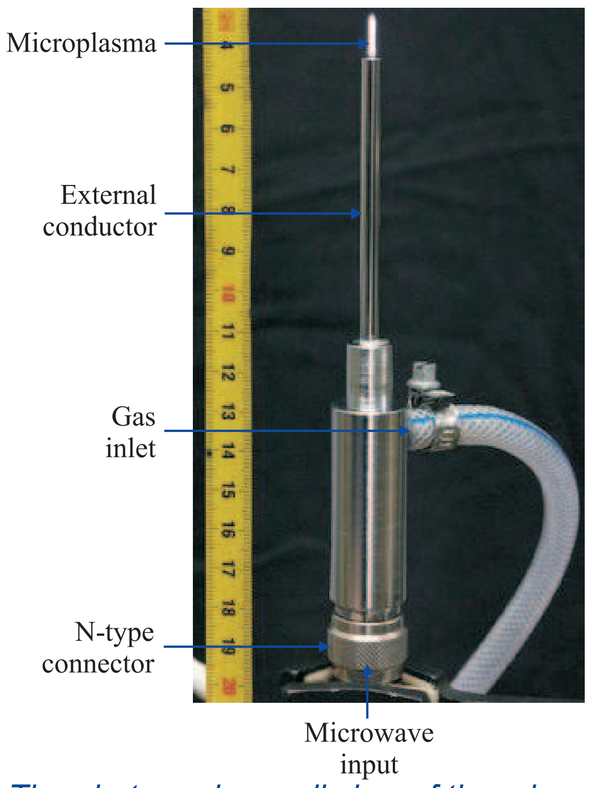
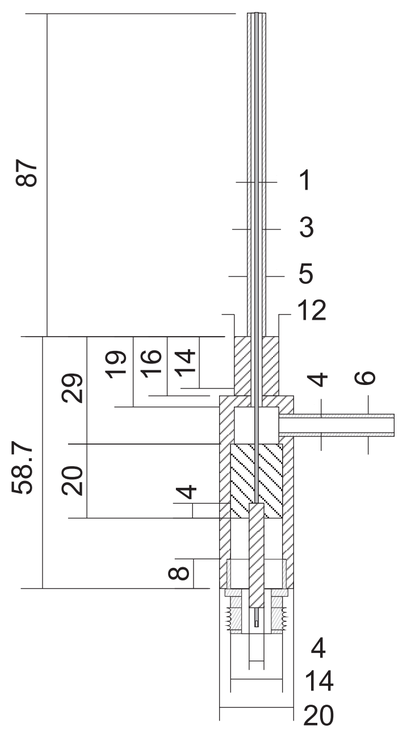
Introduction

The novel atmospheric pressure microwave microplasma source (MmPS) is presented. The main advantages of the MmPS are its small size, simplicity and low cost of construction and operation. The microplasma has a form of a small plasma jet of dimensions of a few mm, depending on the operating conditions. Presented results of experimental investigations were obtained with an argon, krypton, nitrogen and air microplasma, sustained by microwaves of standard frequency of 2.45 GHz. The absorbed microwave power were up to 70 W. The gas flow rate was from 2 to 25 l/min.

Microwave microplasma source





The photo and overall view of the microwave microplasma source (MmPS)

Experimental setup

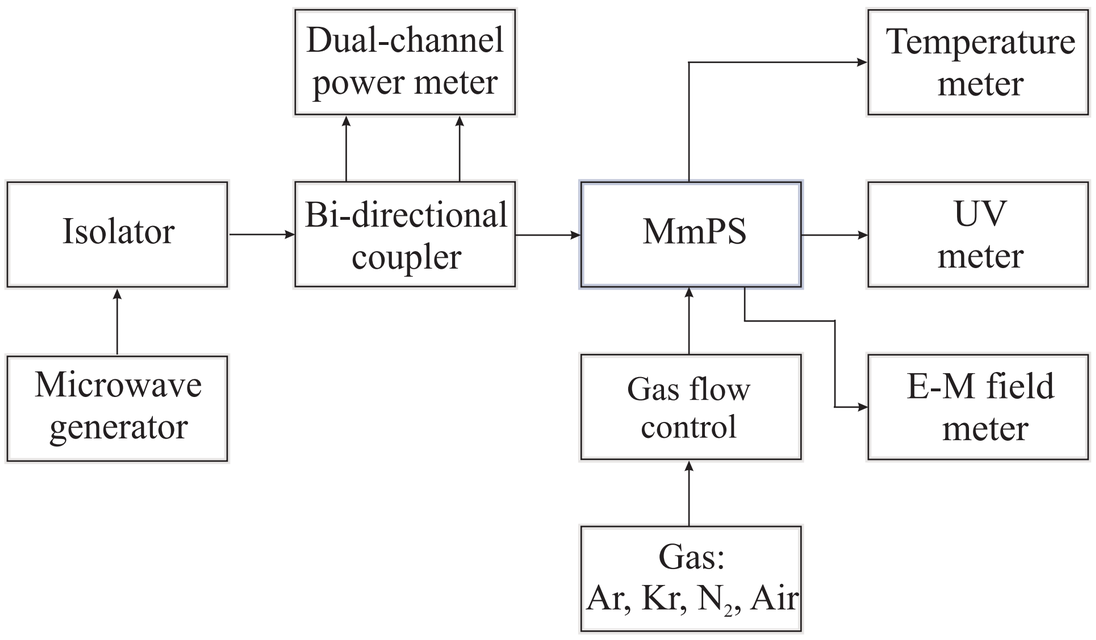
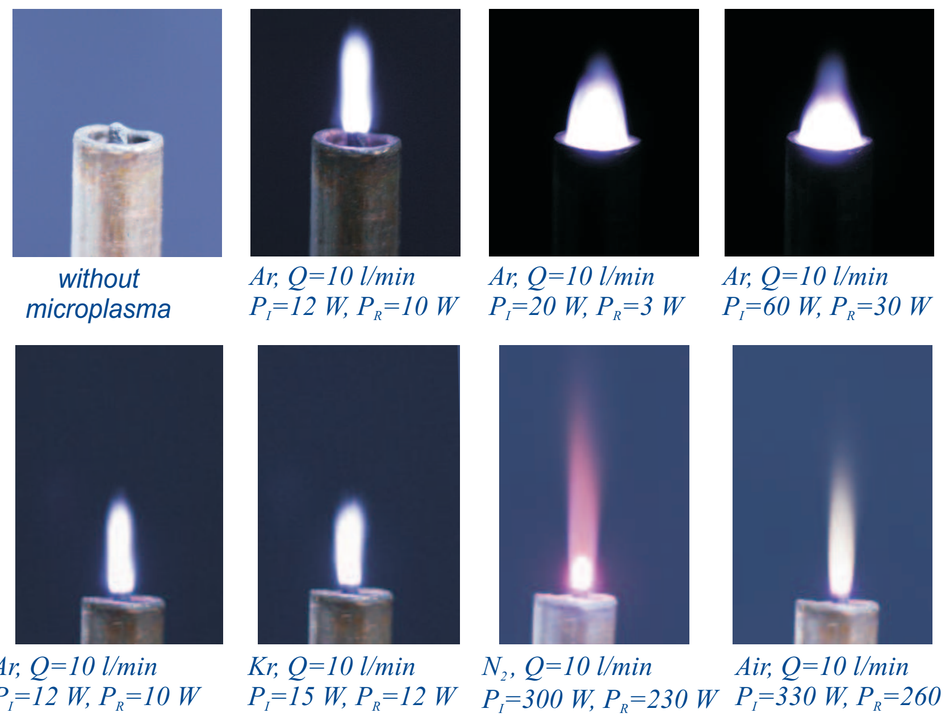


Diagram of the experimental setup

Microplasma visualization



without microplasma

Ar, Q=10 l/min
P_I=12 W, P_R=10 W

Ar, Q=10 l/min
P_I=20 W, P_R=3 W

Ar, Q=10 l/min
P_I=60 W, P_R=30 W

Ar, Q=10 l/min
P_I=12 W, P_R=10 W

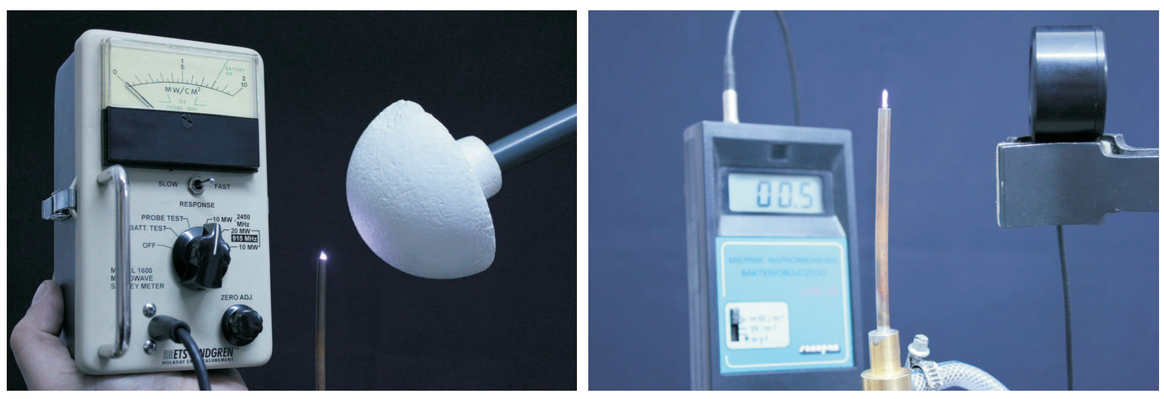
Kr, Q=10 l/min
P_I=15 W, P_R=12 W

N_2, Q=10 l/min
P_I=300 W, P_R=230 W

Air, Q=10 l/min
P_I=330 W, P_R=260 W

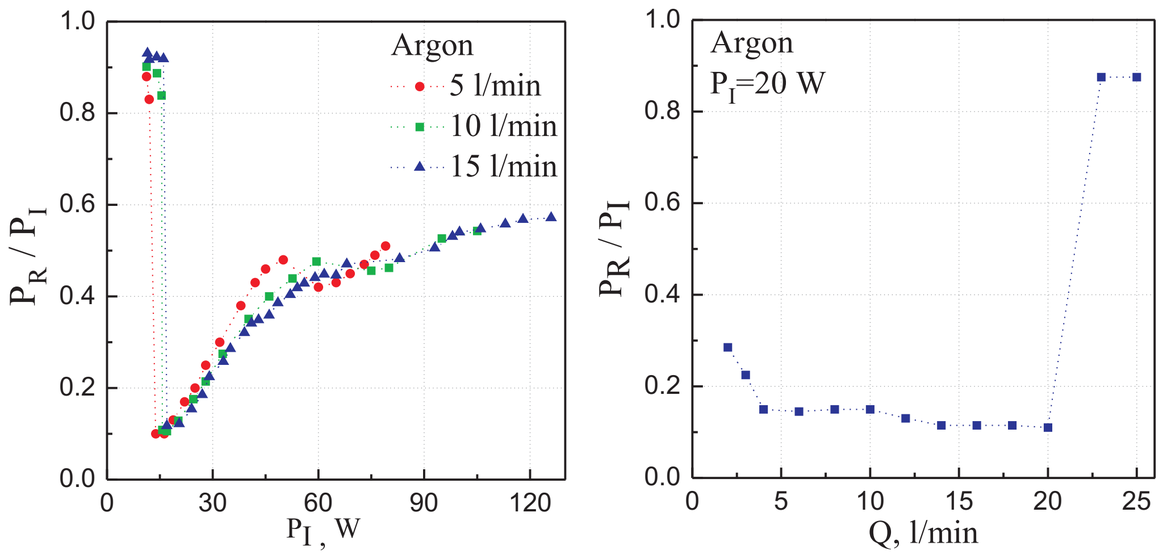
Photos of the microwave microplasma for various operating conditions

Microwave radiation and UV intensity measurements

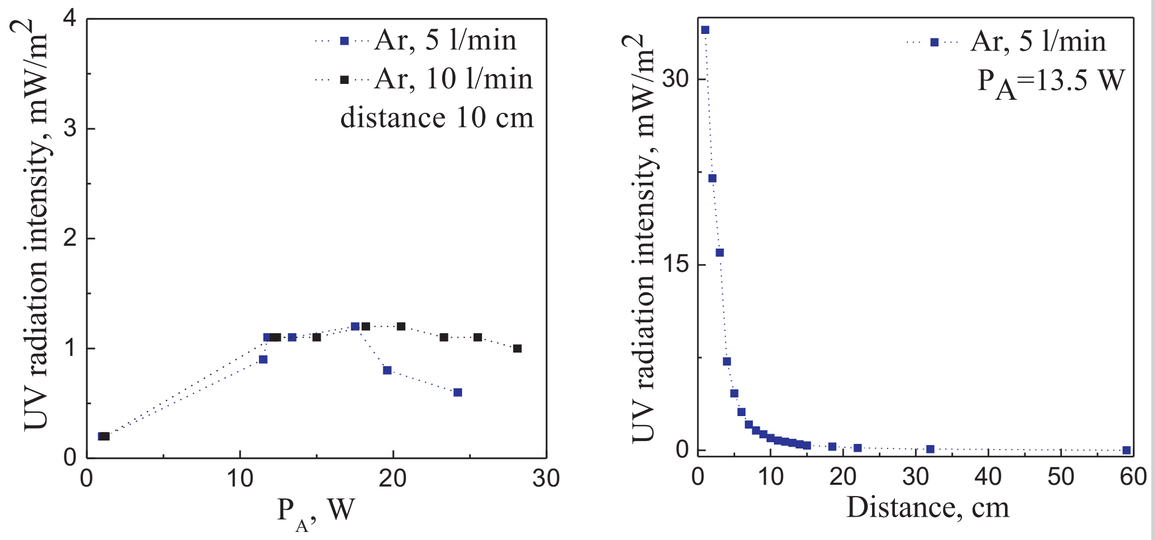


Photos of the microwave radiation and UV intensity measurements. The HI-1600 Holaday EMF Measurement and Sonopan UVB-20 meters.

Experimental results



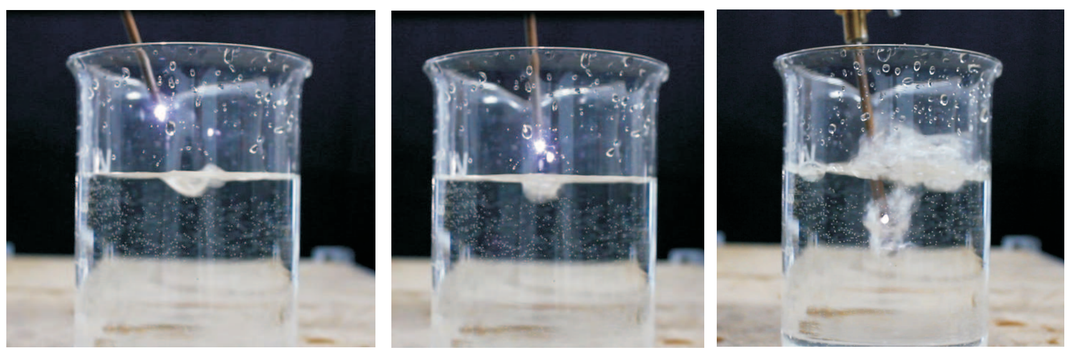
Dependence of the reflected microwave power P_R on the incident microwave power P_I (on the left) and on the gas flow rate Q (on the right)



Dependence of the UV intensity on the absorbed microwave power P_A (on the left) and on the distance from the MmPS (on the right)

Additional features of the MmPS

Photo of the low power Ar microplasma treatment of the human skin



Photos of the Ar microplasma operated in a water

Acknowledgement

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