PlasTEP

plasma for environment protection

Report on tests of optimised modules at simulated conditions

OP6-5.1

PP #12 (IMPPAN, Gdańsk, Poland)

Dr. Mirosław Dors
Mr. Bartosz Hrycak
Mr. Tomasz Izdebski

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1. Introduction

The aim of the WP6 of the PlasTEP project is developing a prototype of mobile device for destruction of oil and oil-type leakages in ports of the Baltic Sea. Following the WP6 schedule Partners from Greifswald in Germany (INP, PP#2), Mikkeli in Finland (LUT, PP#6), Gdańsk in Poland (IMP, PP#12) and Szczecin in Poland (ZUT, PP#13) are obliged to perform joint tests of their modules combined and matched after optimisation. Modules in a final form together with a floating platform form the desired mobile device. Planned tests were carried out in the laboratory of WP6 coordinator, Institute of Fluid-Flow Machinery, Polish Academy of Sciences, Gdańsk, Poland, in March 14-15, 2012 and in May 22, 2012. First attempt in March failed due to a damage of one of key electronic element of the power supply controlling the microwave plasma module operation. This situation forced PP#13 to redesign the power supply. Redesigned power supply was tested with other modules successfully in May 22. Results of these tests are presented briefly in this report.

2. Experimental set-up

All modules were optimised after first tests performed in August, 2011 (see report OP-4.1). They were connected as presented in Fig. 1.

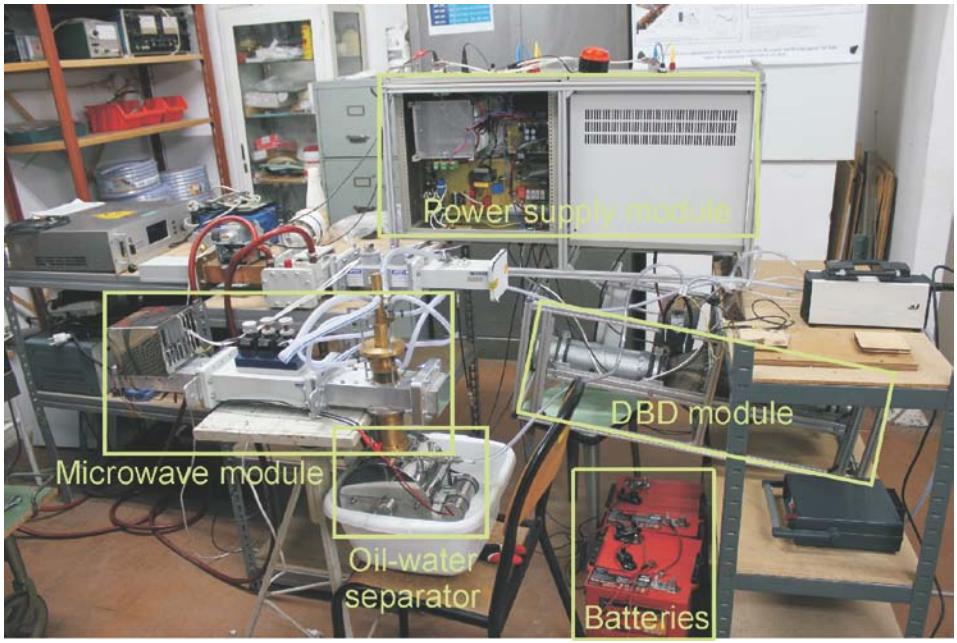

Fig. 1. Test stand construction in a laboratory of the Institute of Fluid-Flow Machinery, Polish Academy of Sciences, Gdańsk (PP#12).

Electrical system, as proposed previously, was basically divided into two groups: dielectric barrier discharge (DBD) reactor supply and microwave plasma magnetron supply. All modules were supplied from batteries, exactly the same way, as will be in the final floating device (Fig. 2). Because the tests were carried out in the closed room, batteries were charged up from the electrical grid instead of solar panel which will be used for charging in the final device.

Fig. 2. Optimised power supply module with batteries ready for the final device.

Optimised DBD module, developed by PP#2 in collaboration with PP#6, consists both DBD reactor and catalytic adsorbers (Fig. 3). It is also equipped with two fans at inlet and outlet of the module the aim of which is to support the gas flow through the module and avoid overheating. After tests presented here the module will be fixed in the final floating device.

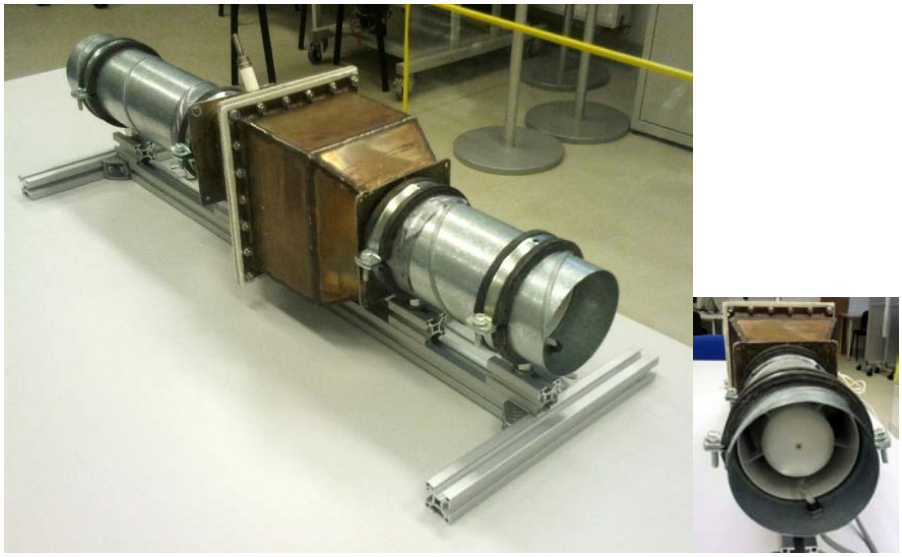

Fig. 3. Optimised DBD module for the final device.

Microwave plasma module used in the tests after optimisation is shown in Fig. 4. It consisted of microwave source based on the magnetron from house oven, power circulator preventing magnetron damage by return wave, 3-stub tuner for matching microwave power to the plasma source, plasma source, and oil-water separator driven by an electric dc motor. For microwave plasma generation argon from the flask was used.

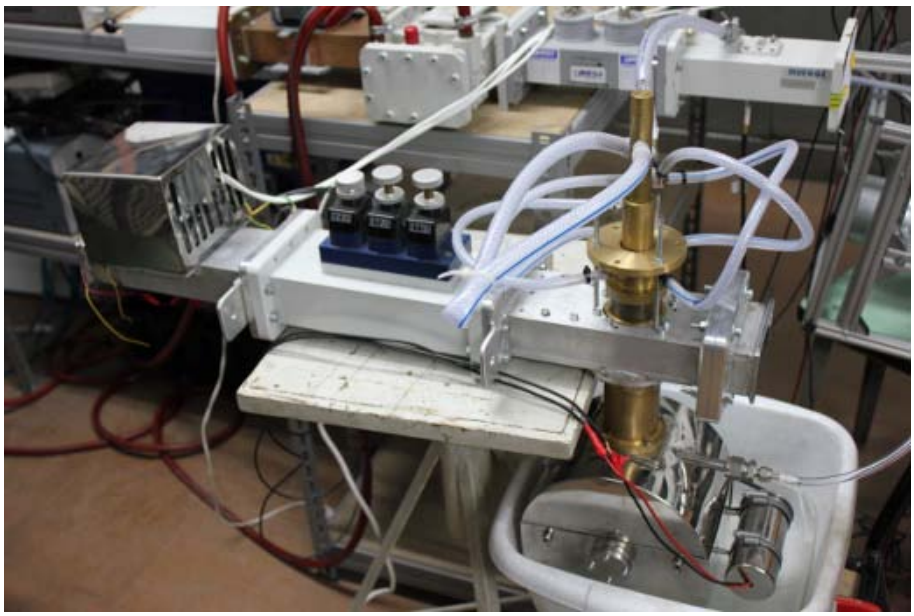

Fig. 4. Microwave plasma module with oil-water separator.

3. Result and conclusion

The aim of the test was the checking of the power supply stability at full load, i.e. with operating microwave plasma, DBD plasma, oil-water separator and gas pump. No gas analysis was carried out since such tests were already done in August 2011 and described in OP6-4.1. Those tests proved that the concept of the oil slick destruction method is correct. The aim of the optimisation of all modules was to ensure stable operation with minimum risk of damages in hardware.

The general result of tests carried out in May 22, 2012, is that all optimised modules work well and stable. The stability of the operation was checked several times during next 3 weeks. None of modules requires further optimisation and they are ready for fixing in the final floating device.