

Report describing scientific activities during the CNR short-term mobility program

For the 10 days stay at the IDAC the following three scientific activities have been planned:

- 1) Experimental study of light emission from spark generated bubbles
- 2) Experimental study of temperature inside spark generated bubbles
- 3) Experimental study of finite amplitude waves radiated by spark generated bubbles

A literature survey has assured us that light emission from spark generated bubbles has not been studied previously. Thus we were entering a new field of research and having only 10 days for our experimental work it was clear that there is no time available for developing new optic sensors or modifying old ones at the IDAC. Hence to study light emission from spark generated bubbles 5 optical sensors have been prepared at the Technical University of Liberec during the spring 2009. These five sensors differed in their sensitivity, immunity to electromagnetic interferences etc. and it was assumed that at least one of them will enable us to obtain suitable data.

After some initial trials lasting 3 days, real experiments have been started at the IDAC. During these experiments different optic sensors have been used and their position relative to the bubble center has been varied. The experiments have been done with bubbles of different sizes and oscillating with different intensities. These variations in the bubble sizes and oscillation intensities have been obtained using different discharge condenser capacities and different gap lengths in the sparker. Concurrently with light emission also pressure waves radiated by oscillating bubbles have been always recorded. These pressure waves make it possible to determine, after suitable processing, the bubble sizes and oscillation intensities. The intention is to determine correlation between observed light emission and the bubble size and oscillation intensity.

At first sight the data obtained seem to be very promising. After processing and analyzing the records from optic sensors (used to study light emission) and from hydrophone (used to record the pressure waves) we intend to publish these preliminary results at an international conference.

Due to natural limitations the data obtained so far have a qualitative significance only. However, after analyzing the performance of the optic sensors we plan to prepare new sensors. We wish to calibrate these new sensors at a metrological institute. With these new sensors we intend to perform a new series of measurements in September 2010 to obtain not only qualitative, but also quantitative results. And we hope these new results will be already suitable for publishing at a high impact international scientific journal.

We have also spent some time by trying to determine temperature inside oscillating bubbles. For these measurements we used a sensor given us by Professor D'Amico, a scientific collaborator of the IDAC. However, these temperature measurements have not yielded data which could be easily interpreted. Therefore temperature measurement experiments have been stopped and it was agreed that a supporting experiments aiming at clarifying the probe response have to be done first. After clarifying the sensor behavior a new series of temperature measurements can be started in September 2010.