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Report on the dissertation titled “Experimental description of the high-voltage electric current passage through low-conducting liquids based on dynamic current-voltage characteristics” presented by Andrei Aleksandrovich Sitnikov, submitted for the PhD degree of physical and mathematical sciences (ученая степень Кандидата физико-математических наук) in Specialization 01.04.13—Electrophysics, electrophysical installations

The dissertation of Andrei Aleksandrovich Sitnikov concerns the experimental study of processes related to the charge formation and ion transfer in the presence of high-voltage in weakly conductive liquids. The topic of the electric current flow in conducting dielectric liquid media is very timely, mainly due to potential applications of liquid electrohydrodynamic devices.

The dissertation reviewed was aimed at justifying the usefulness of the so-called dynamic current-voltage characteristics of the low-conducting liquid system for describing and analysis of the current flow through the low-conducting liquid under high voltage condition. The Author presents in his dissertation the most characteristic examples of many original studies, which support the Author’s hypothesis that the dynamic current-voltage characteristics can be used for describing the processes of the electric charge formation and ion transfer in weakly conductive liquids under high-voltage condition. The original results presented in this dissertation were derived from the experimental studies and computer modelling carried by the Author. Based on these data the Author presented a detailed physical interpretation of the dynamic volt-ampere characteristics, linking it with various mechanisms of the charge

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formation and current transfer, including the convective current caused by the electrohydrodynamic flow in weakly conductive liquid in the presence of high-voltage.

The scientific novelty of the results presented in the dissertation reviewed are as follows:

1. For the first time, the main factors influencing the electric current flow in low-conducting liquids under high-voltage conditions were experimentally determined and linked to the dynamic current-voltage characteristics.
2. A new method for determining the electrical capacity of the system with arbitrary configuration of the electrodes was developed and effectively used in processing the experimental dynamic current-voltage characteristics.
3. Time-resolved observation of the physical processes occurring in the low-conducting liquids under high-voltage condition (e.g. the degradation of metal-liquid pair or the change of liquid temperature) with the use of the dynamic current-voltage characteristics.
4. Supporting the experimental results on the linkage between the dynamic current-voltage characteristics and the mechanisms of the electric charge formation in the low-conducting liquids with numerical modelling.

A.A. Sitnikov presented his scientific results as a co-author in 6 articles in the international journals, indexed in the data bases of Web of Science and Scopus. He delivered 3 oral and 2 poster presentations at international conferences. A.A. This has already been recognized by the international community. The results obtained by A.A. Sitnikov and co-authors were considered worth presenting at the International Symposium on Electrohydrodynamics ISEHD 2017 (Ottawa, Canada) in the form of an invited lecture. On the next International Symposium on Electrohydrodynamics ISEHD 2019 (St. Petersburg, Russia) A.A. Sitnikov received a diploma for the best poster of young scientists.

I would like to take this opportunity to ask A.A. Sitkov for a public comment at the meeting of the Dissertational Council for defense of A.A. Sitkov's dissertation on the interpretation of

the dynamic current-voltage characteristics for various rise rates of the amplitude of the sawtooth voltage applied to the low-conducting liquids. A comment on the transient physical phenomena in the low-conducting liquids under the sawtooth voltage for various voltage amplitude rise rates is welcome.

In my opinion, the dissertation of Andrei Aleksandrovich Sitnikov, titled “Experimental description of the high-voltage electric current passage through low-conducting liquids based on dynamic current-voltage characteristics” fulfils the requirements for granting a PhD degree of physical and mathematical sciences (ученая степень Кандидата физико-математических наук), established by the Decree (Приказ) No 6821/1 dated September 01, 2016 “On the Order of Granting Degrees in St Petersburg State University” (“О порядке присуждения ученых степеней в Санкт-Петербургском государственном университете” (с изменениями и дополнениями)). After a careful analysis of the doctoral dissertation, I am firmly convinced that Andrei Aleksandrovich Sitnikov deserves to be granted with a PhD degree of physical and mathematical sciences (ученая степень Кандидата физико-математических наук) in Specialization 01.04.13—Electrophysics, electrophysical installations.



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The Dissertation Board member

The Chairman of the International Symposium on the Electrohydrodynamics

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