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優勝作品專輯(國外作品)

作品編號	140041
參展科別	物理與太空科學科
作品名稱	Building Bridges with Water-The Floating Waterbridge
得獎獎項	一等獎

國 家	Germany
就讀學校	Hans-Thoma-Gymnasium
作者姓名	Carolin Charlotte Lachner

ABSTRACT OF EXHIBIT

TAIWAN INTERNATIONAL SCIENCE FAIR

This paper describes the investigation of a fascinating physical phenomenon called the “floating water bridge”. Despite the fact that water is undoubtedly the most important chemical substance on earth, it is practically ubiquitous and it still represents one of the best explored substances, still not all characteristics are well-understood. There are some phenomena like the “floating water bridge”, which cannot be explained. If high voltage is applied to two beakers, which are arranged close to each other and which are filled with deionized water, a connection forms spontaneously, giving the impression of a floating water bridge. For the experiment discussed in this paper, two beakers with a diameter of 50 mm and a height of 80 mm are filled with triply deionized water. Platinum electrodes are submerged in the center of the beakers, one set to ground potential (anode), the other one on high voltage, up to 25 kV dc. Within the scope of this work, an experimental setup was developed, which enables measuring and demonstrating the most important parameters like voltage, current, length and temperature of the water bridge as well as the mass transfer between the beakers. In addition the correlation between the different parameters and the influence on the water bridge could be estimated. Once the beakers are separated, the bridge remains stable for several hours up to a length of 2.5 cm. With platinum electrodes and no electrolysis observed, a small current ($\approx 300\mu\text{A}$), a mass flow from anode to cathode and forces were measured. Pictures, taken with an infrared camera and a new developed method to record "infrared-videos", enabled to visualize the heat flow in the water bridge. Furthermore the conversion of energy and the dependence of charge and mass transfer could be estimated roughly. In the course of the investigations it was also tried to prove the water bridge with other liquids like castor oil, olive oil, a mixture of glycol and water as well as tap water - for some of them for the first time. Supplementary the experimental setup was varied by using different electrodes with different sizes and different material as well as beakers of different sizes and materials. In addition, a qualitative explanation was developed. The results of this work enable a better understanding of the floating water bridge and provide a basis for further research as well as for development of future practical applications. One of these applications could be an improved waste water treatment process.

評語

This is a very innovative project in terms of new finding and scientific investigation. The phenomenon that the water will bridge between separate fully filled water containers under the drive of electric potential is scientifically interesting and worthy further investigation. Apparently the project has done a great job in initiating various investigations in several interesting aspects. The work is rather complete in terms of presentation and of being a pioneer study. Well done!