Nanobubble Conductors -The Unexpected Hall and Temperature Characters

Yang, Cheng-Jui (School: National Chiayi Senior High School)
Hsu, Han-Yuan (School: National Chiayi Senior High School)
Wang, Yu-Chi (School: National Chiayi Senior High School)

Generations of stable nanobubbles (NBs) in aqueous solutions have been demonstrated to be feasible. Their physical characters and applications, however, remain to be discovered. In this project, we focus on the electrical behavior of NBs generated in distilled (DI) water. A nozzle of diameter 3 mm was used to slowly purge the gas into DI water. A sonication process after purging was used to select and unify the size of NBs in DI water. Stable oxygen, carbon dioxide or nitrogen NBs with diameters in the order of 100 nm that may last for months can then be incorporated into DI water. It is surprising to find that the appearance of NBs enhances the electric conductivity of DI water by as large as one hundred thousand times to reach the range of semi-metal. Even more interestingly, a huge temperature coefficient of 0.22 K-1 that enhances the conductivity by 22% per degree temperature change of the DI water incorporated with 150 nm oxygen NBs. In addition, Hall voltage has also been detected in the NB conductors, which reflects a charge carrier density in the order of 10-3 C/cm3 to appear in the DI water. These phenomena can be understood by taking that NBs result in an increase of hydrogen and hydroxide ion concentration. The large mobilities of hydrogen and hydroxide ions give rise to a considerably large Hall coefficient.

Awards Won:
Third Award of $1,000