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Title:

Emergent Functions of Electrically-induced Bubbles

Abstract:

The presentation is about the mechanism and structure of our developed electrically-induced bubble knife and its wide applications. The novelties is that simultaneous local reagent injection and perforation to the materials of variety of hardness using bubble cavitation and plasma cavitation. Cavitation and plasma discharge were generated by pulse discharge of microelectrode having special tip structure. Injection to soft material such as animal cell was performed only by cavitation of bubble, and pore formation to hard materials such as seeds of plants or metals were achieved by synergistic effect of cavitation of bubble and plasma ablation. The novelty of the technique enable to process not only conductive material but also non-conductive material such as polymer, CFRP and silicon wafer, which is unlike conventional wire electric discharge machine. Also, the directional transportation of bubbles provides positioning accuracy of micro-processing. Moreover, we focused on the reducing power of hydrogen radical by plasma discharge and the micro-jet caused by collapse of microbubble, and aim at developing a metallization method which does not need a complicated process such as surface treatment. It was confirmed that the nanoparticle synthesis and implanting of them using a bubble injector. This simultaneous etching and deposition methods provide novel printing method of electrical circuit on wide range of material.

Biography:

Yoko Yamanishi has received the Ph.D. degree from Imperial College London (Thermofluids Section in Mechanical Engineering Department) in 2003 by the work of simultaneous optical measurement of size, temperature and velocity of a single coal particles with a combination of pyrometric and diffraction light techniques. She has joined department of mechanical engineering of Shibaura Institute of Technology, Japan in 2004-2005 as a lecturer. Then, she became a postdoctoral fellow of Department of Bioengineering and Robotics, Tohoku University in 2006 and Assistant Professor in 2008-2009, mainly have engaged in the research fields of BioMEMS and micro multiphase flow which apply to the Bio-medical Science and Engineering. She became Associate Professor of Department of Micro-Nano Systems Engineering, and Department of Mechanical Science & Engineering of Nagoya University and also a member of PRESTO JST during 2010-2012, and have started her work of electrically-induced bubble (needle-free bubble injector). She was Associate Professor of Department of Mechanical Engineering of Shibaura Institute of Technology during 2013-2015, and her work has been expanded to plasma-induced bubble and its biomedical applications. She moved to Kyushu University on April, 2016 and she became Professor of department of Mechanical Engineering, Kyushu University and leading biomedical fluid engineering laboratory. She is currently a member of CREST JST(delivery of long-chain DNA by the novel bubble injector and microstructures) and PM of moonshot (Interdisciplinary Frontier of Bio-order Extended by Nano- and Micro-bio Avatars). She is a member of IEEE, JSME, RSJ and so on.