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PII: S1350-4177(18)30115-9
DOI: https://doi.org/10.1016/j.ultsonch.2018.03.019
Reference: ULTSON 4132

To appear in: *Ultrasonics Sonochemistry*

Received Date: 26 January 2018
Revised Date: 16 March 2018
Accepted Date: 26 March 2018

Please cite this article as: R. Pflieger, L. Gravier, G. Guillot, M. Ashokkumar, S.I. Nikitenko, Inverse effects of the gas feed positioning on sonochemistry and sonoluminescence, *Ultrasonics Sonochemistry* (2018), doi: https://doi.org/10.1016/j.ultsonch.2018.03.019

# Inverse effects of the gas feed positioning on sonochemistry and sonoluminescence

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## Abstract

Purging of solutions to enhance sonochemical reactions is a common practice. A fundamental study combining sonoluminescence spectroscopy and sonochemical activity is adopted to study the effects of continuous Ar gas flow in the solution and of the position of the gas inlet tube on high-frequency sonolysis of aqueous solutions. It has been observed that neither sonochemical activity nor sonoluminescence intensity is controlled by the gas solubility only. Besides, the change in position of the gas inlet tube leads to opposite effects in sonoluminescence intensity and sonochemical activity: while the former increases, the latter decreases. Such an observation has never been reported despite sonochemical reactions have been carried out under different gas environments. Sonoluminescence spectroscopy indicates that more extreme conditions are reached at collapse with the gas inlet on the side, which could be explained by a more symmetrical collapse. Finally, it is shown in certain conditions that it is possible to favor the formation of some sonochemical products simply by positioning the gas inlet at different positions, which has practical significance in designing large scale sonochemical reactors for industrial applications.

## 1. Introduction

Sonochemistry refers to chemical reactions that arise when a solution is submitted to power ultrasound. Its origin is acoustic cavitation, the nucleation, growth and implosive collapse of microbubbles containing gas and vapor. Due to the violent nature of the fast collapse, a plasma is formed inside cavitation bubbles.[1] This plasma emits light, the so-called sonoluminescence (SL). Spectroscopic studies in argon saturated water showed that excited species vibrational temperatures of the order of 10000 K could be reached.[2]

Obviously, the conditions reached at bubble collapse are influenced by the nature of the dissolved gas, in particular by its polytropic index, thermal conductivity and solubility, [3, 4] and ionization potential[5]. The gas solubility is of particular interest because it can be somehow tuned by the experimental conditions: pressure, solution temperature, acoustic power and thus extent of ultrasonic degassing. Okitsu et al.[6] in their study under mixtures of