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Sonochemistry with bubbles stabilized in micromachined pits

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ABSTRACT

The sonochemical generation of radicals by applying ultrasound in the medium kHz regime (100 - 500 *kHz*) at pressures up to 500 *kPa* to gas bubbles embedded in pits with 5-50 μm radius micromachined in silicon substrates was studied. The gas bubbles entrapped in the pits are stable for hours, and their oscillation leads to the ejection of micrometer sized bubbles. By using luminol as a chemiluminescent dye to visualize radical production by cavitation, we could demonstrate that these expelled microbubbles are chemically active. To quantify this activity, the product of the reaction of terephthalic acid with the hydroxyl radicals generated in the sonochemical process was measured by a fluorescence method. The results show an increase in total energy efficiency (expressed in the amount of radicals generated per unit power injected to the system) of one order of magnitude, compared to an experiment without the surface bubbles. This significant increase is reached with just a small number of pits per unit area which can be increased if necessary.

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