OC-39: Sonochemistry Past Present and Future

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It is always a valuable exercise to review the origins and developments of a technology before going on to look at future prospects. Such an exercise allows one to judge both whether that technology has real long term applications or is simply of transient interest on a laboratory scale. In the field of power ultrasound it is a fact that many applications predated the advent of sonochemistry by many years and a number of books and articles were written that explored laboratory and industrial applications of ultrasonics from the 1920's

This talk has two aims the first being to review of the historical origins of ultrasound technology that has become known as sonochemistry. The second is to illustrate some current developments of the technology.

In science it is always important to appreciate and give credit to the contributions of those who were pioneers of original research generally working with much poorer facilities than we have nowadays. In this way we can make sure that in our own research we are not simply "re-inventing the wheel" but either developing a new field or adding to existing knowledge. It is becoming more important that this should be done as a basic part of any new project to avoid the trap fallen into by so many new research students of believing that all knowledge is to be found in the search engines and files accessible using a computer.

As we all know sonochemistry and ultrasonic processing are driven by cavitation which was first identified and characterized in 1895 when Thornicroft found that it was the reason why there was inefficient drive from the propellers of the high speed torpedo boat HMS Daring [1]. This and subsequent very early studies were all linked to the type of cavitation produced by propellers driving through water i.e. hydrodynamic cavitation. The other type of cavitation is induced by sound and termed acoustic cavitation and is the sort that is more familiar to sonochemists. Originally cavitation bubbles were considered to be empty and in 1917 by Lord Rayleigh developed ideas relating to the behaviour of the collapse of a "spherical void" in an incompressible fluid [2]. Acoustic cavitation bubbles do however contain vapour and in 1949 significant advances in the development of mathematical treatment of acoustic cavitation came with the work of Plesset [3]. He developed an equation for the motion of a vapour-filled bubble in a changing pressure field.

One of the earliest books dealing with the uses of sound energy as a power source was published in 1918 [4]. Although it does not deal exclusively with ultrasound it contains many good ideas and should be sought out. Later texts concentrating on ultrasound are also valuable sources of ideas and applications [5].

It should always be borne in mind that what one might consider to be a breakthrough in sonochemistry could well have been mentioned previously in early publications within a subject not previously referred to as "sonochemistry".

References

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