

## Sonosynthesis of various types of micro- and nano-materials



### Abstract

Ultrasonic energy was used as a means of formation of micro- and nano-materials from the liquid state. These include pure metals, alloys, oxides, carbon dots and protein spheres.

We first focused on the formation of micro- and nano spheres of low-melting point metals ( $mp < 400$  °C) metals, starting from their molten state under silicone oil. Ultrasonic irradiation of the system induces shear forces in the oil that rapidly disperse the molten metal into numerous tiny spheres. These forces are created during the collapse of the gas bubbles in the cavitation process. The spheres did not recombine to bulk metals after sonication was ceased, although the surrounding temperature was still higher than their melting points, probably due to the formation of a coating carbon layer on the spheres, as a result of reactions of the metals with the liquid media under the extreme local conditions of pressure and temperature that develop during the short time of the bubble collapse. This method was applied to several metals (Pb, Zn, In, Sn, Ga, Bi, Hg), as well as two eutectic alloys (Au-Ge and Au-Si). We also applied this method to molten Ga ( $mp$  29.7°C) under warm water and extended it to aqueous solution containing various metal ions or organic compounds that could interact with the formed Ga particles in various ways.

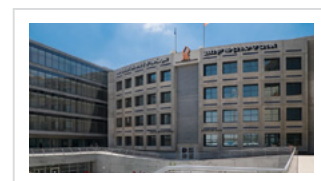
Ultrasonic irradiation of organic liquids, such as polyethylene glycol (PEG) 400, yields carbon dots (C-dots). During sonication, the collapsing gas bubbles in the liquid act as micro-reactors in which extreme transient conditions induce some decomposition of the PEG and formation of C-dots. Their average diameter is 2-9 nm, depending on the preparation conditions. When the PEG contained molten Ga or Sn, metal doped C-dots were formed, which may be applicable as antibacterial agent (Ga@C-dots) or in photocatalysis (Sn@C-dots).

**Ze'ev Porat, Vijay B. Kumar and Aharon Gedanken**

Ben-Gurion University of the Negev, Israel

### Biography

Ze'ev Porat gained the B.Sc. degree in chemistry from the Tel-Aviv University and both M.Sc. and Ph.D degrees from the Weizmann Institute of Science, Rehovot, Israel. After a post-doctoral term at the University of North Carolina, Chapel Hill (USA), he joined the nuclear research center-Negev, Israel, in 1994 as a senior researcher. Teaching analytical chemistry at the Ben-Gurion University since 2001 and in 2019 was nominated as an adjunct professor at the unit of environmental engineering. The main areas of activity are sonochemistry, analytical chemistry, electrochemistry and teaching.



[3<sup>rd</sup> International Conference on Nanomaterials](#) | August 29-29, 2020

**Citation:** Ze'ev Porat, Sonosynthesis of various types of micro- and nano-materials, Nanomaterials Congress 2020, 3rd International Conference on Nanomaterials, August 28-29, 2020 | Webinar, 07