Plasma discharge under the effect of intensive ultrasound and its application for plasma-chemical synthesis of functional nanomaterials

Bulychev N.A.[1,@]

[1] Moscow Aviation Institute, Volokolamskoe Shosse 4, Moscow, 125993, None

[@] nbulychev@mail.ru

In the work, plasma-chemical processes determined by the combined effect of thermally nonequilibrium low-temperature plasma and intensive ultrasonic vibrations in the cavitation regime in liquid-phase media were studied. This method of plasma-chemical synthesis of nanomaterials is of considerable interest and has advantages for creating new nanosized materials with specific properties, since it allows for targeted variation of the electrophysical and acoustic characteristics of the process during plasma-chemical reactions. A practical consequence of solving this problem is the creation of a method for the targeted synthesis of valuable substances. A distinctive feature and significant advantage of this method is that the simultaneous effect of thermally nonequilibrium plasma and ultrasonic cavitation on the reaction zone leads to the emergence of conditions that are unattainable in other cases and causes reactions to occur at a high local concentration of energy and active particles. So it is possible to synthesize nanoparticles of metals and their oxides of various compositions, while the size of the primary nanoparticles was at the level of 2–80 nm depending on the material. Further on, it was shown that nanoparticles of various compositions synthesized in such conditions have an activated surface with a large number of uncompensated bonds and defects as a result of the action of intensive ultrasound. Thus these particles are capable of effective interaction with organic and inorganic compounds, matrices, etc, which allows creating new hybrid organic-inorganic composite materials as well as polymer nanocomposites. This work has been financially supported by the Russian Science Foundation, project No. 23-19-00540.