PLASMA DYNAMIC SYNTHESIS OF IRON OXIDES IN A DISCHARGE PLASMA JET WITH POSSIBILITY TO CONTROL FINAL PHASE COMPOSITION

***IVAN SHANENKOV**, ALEXANDER SIVKOV, ALEXANDER IVASHUTENKO AND MAXIM GUKOV*

National Research Tomsk Polytechnic University, Russia
Swordi@list.ru

Magnetite Fe_3O_4 and epsilon iron oxide ε-Fe_2O_3, having excellent frequency characteristics and high electrical resistivity, are considered as the most promising phases among all iron oxides for using in high-frequency equipment in order to increase the working frequency of the data transmission. Despite the large number of existing methods for synthesizing these materials, many of them do not provide obtaining both of these phases. Nonetheless, those methods, which allow doing that, suffer from such disadvantages as the process duration, the necessity to use expensive precursors and the low yield of the final product. In opposite to these methods, the plasma dynamic synthesis can provide the synthesis of necessary phases in one-step process. The process is implemented in an electrodischarge iron-containing plasma jet, which interacts with gaseous precursor (oxygen). The use of plasma jet allows obtaining nanoscale powdered products.

This work shows the results of the experiment series, where the influence of initial energy parameters on the final phase composition was studied. It is found that the plasma dynamic synthesis allows obtaining both magnetite Fe_3O_4 and epsilon phase ε-Fe_2O_3 during one short-term process (less than 1 ms). It is also established that the final phase composition strongly depends on the initial parameters of the system. The increased energy parameters lead to the formation of the product with predominant content of epsilon phase, while lower parameters allow synthesizing magnetite phase. Thus, by changing energy parameters, it is possible to control the final composition in the considered system.

Keywords: *Electro discharge plasma, Pasma dynamic synthesis, Soft magnetic iron oxides, Energy parameters, Phase composition.*