THE STUDY OF FORMATION OF METAL–CARBON NANOPARTICLES IN SHOCK WAVES: KINETICS AND MECHANISMS OF NUCLEATION AND GROWTH OF METAL NUCLEI AND CARBON SHELL FORMATION

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Abstract: Experimental and simulation study of the formation of iron nanoparticles during thermal decomposition of iron pentacarbonyl $Fe(CO)_5$, carbon (soot) nanoparticles during ethylene C_2H_4 pyrolysis, and iron nanoparticles encapsulated into carbon shell during the heating of a mixture of $Fe(CO)_5 + C_2H_4$ in argon behind reflected shock waves was carried out. Microstructure of these nanoparticles was investigated with the help of a high-resolution field-emission scanning election microscope Zeiss Ultra plus (Ultra 55). The detailed kinetic modeling of the processes of thermal decomposition of iron pentacarbonyl molecules and condensation of iron atoms with the formation of iron nanoparticles, the formation of carbon (soot) particles during ethylene pyrolysis, and the joint process of formation of iron and carbon particles and iron particles encapsulated in a carbon shell was conducted.

Keywords: encapsulated nanoparticles; nanoparticle microstructure; field-emission scanning electron microscope; shock waves; kinetic modeling

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