Title: In-flight modification of nanoparticles by chemically active plasma

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Abstract:

This diploma thesis is focused on a fabrication of the iron nanoparticles using the gas aggregation source with a planar magnetron and their in flight modification by chemically active plasma. The modification of the nanoparticles is based on a radiofrequency glow discharge, that takes place right after the nanoparticles flew out of the gas aggregation source. Nanoparticles are prepared in an argon atmosphere in which a small amount of the *n*-hexane has been admixed. This *n*-hexane impurity caused an increase in a deposition rate and higher time stability. The modification takes place in a glow discharge containing a pure argon, or in the mixtures of argon with *n*-hexane, ethylendiamine, hydrogen or nitrogen. Prepared nanoparticles were characterized using the X-ray photoelectron spectroscopy, scanning and transmission electron microscopy, X-ray diffraction and other techniques. The main aim of this work was to study the influence of the additional discharge on the iron nanoparticles. The chemical composition of the nanoparticles was measured immediatelly after their deposition without breaking the vacuum and after air exposion to study their oxidation on the air. It has been found, that *n*-hexane admixed in the aggregation chamber was absorbed in growing structure of the nanoparticles. Nanoparticles modified by the additional plasma containing *n*-hexane, ethylendiamine, hydrogen and nitrogen were easily oxidized by exposition on the air. The protective shell hasn‘t been formed. Oxidation of the nanoparticles, treated by the auxiliary argon plasma, was reduced. These nanoparticles were crystalline with the structure of Fe_3C.

Keywords: Nanoparticles, Gas Aggregation Source (GAS), RF discharge modification