One of the important challenges in materials science today is the preparation of nanostructures with accurately controlled properties and dimensions. The most challenging nanosystems are nanowires owing to highest anisotropy parameters in them, which could certainly increase functional properties of nanomaterials. However, the use of the nanostructures is strongly restricted because of their low stability. The stability of nanoparticles could be increased by several methods, but the most attractive of them is based on the encapsulating of nanoparticles in a chemically inert matrix. The promising matrices for preparation of anisotropic nanoparticles are zeolites (Y and ZSM-5) and mesoporous aluminosilicates (MAS) providing an ordered system of cavities which are perfect reactors for synthesis of nanocomposites due to the limitation of reaction zone by the pore walls.

Preparation of aluminosilicates was carried out by hydrothermal treatment of a mixture containing silica and $\text{Al}^{3+}$ sources and alkylamines as structure directing agents. To get rid of the template molecules the samples were annealed in oxygen flow at 550 °C. According to XRD-analysis of initial matrices no additional phases were observed. Chemical composition of matrices was determined by chemical analysis and TGA of ammonium-exchanged samples.

Iron (III) nitrate, iron (II) sulphate and iron pentacarbonyl have been chosen as iron sources. The ion-exchange procedure was performed by the treatment of porous matrices in the corresponding solution of iron salt. Obtained samples were reduced at 673K in hydrogen flow for 3 hours. Iron pentacarbonyl was intercalated by soaking initial matrices in $\text{Fe(CO)}_5$ at room temperature in argon atmosphere for 24 hours. Obtained samples were thermally decomposed in hydrogen flow at different temperatures (200-700 °C). Composition, structure and properties of iron-containing aluminosilicates were characterized by XRD, chemical analysis, electron microscopy, mossbauer spectroscopy and magnetic measurement.

The magnetic measurement of Fe/Y composite indicate superparamagnetic behavior with no coercivity even at 4K which could be explained by the formation of isotropic iron clusters ($<0.7$ nm). TEM studies confirmed the absence of large iron particles on outer surface.

XRD data for Fe/ZSM-5 composites shows that decomposition of iron pentacarbonyl and growth of iron particles doesn’t cause decomposition of zeolites lattice at all the temperatures of treatment. No evidence of iron or any other phase besides ZSM-5 was observed, even in the samples decomposed at 600 °C. The magnetic measurements of Fe/ZSM-5 composites indicate their ferromagnetic behavior at room temperature which could be explained by the formation of anisotropic iron clusters in 1D-pores of ZSM-5. The coercivity at room temperature for annealed samples has a maximum (670 Oe) for the sample crystallization temperature of 450 °C.

According to TEM Fe/MAS composite doesn’t contain iron particles on the outer surface of aluminosilicates, suggesting the formation of nanowires in aluminosilicate channels. The samples indicate ferromagnetic behavior and have a maximum of coercivity of 390 Oe at room temperature for the reduction temperature of 400 °C.