EFFECT OF PRECIPITATION CONDITIONS ON THE MAGNETIC AND SORPTION PROPERTIES OF MAGHEMITE-ZEOLITE COMPOSITES

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Natural zeolite (clinoptilolite) from Nižný Hrabovec (Slovakia) has been magnetically modified through maghemite (γ-Fe_2O_3) nanoparticles by precipitation route at various reaction conditions. An effect of the precipitation temperature, weight ratio of Fe/zeolite and interaction time on the magnetic and surface properties of maghemite-zeolite composites was monitored by Mössbauer spectroscopy, TEM and BET surface area measurements. A decrease in reaction time and the Fe/zeolite ratio leads to smaller particles of γ-Fe_2O_3 while lowering the precipitation temperature results in the larger crystallites. The reflection of the precipitation temperature being the key variable in the sorption properties of composites was tested with selected heavy metal ions. The sample prepared at highest temperature of 85 °C reveals much higher maximum sorption capacity for Pb^{2+} than commonly observed for magnetically modified natural zeolites. Good ability for sorption of anions was demonstrated with AsO_4^{3-}, which offers new applications of such modified zeolites. The sample with the best sorption properties was characterized by SEM, XRD, in-field Mössbauer spectroscopy and magnetic measurements. Following these data, maghemite nanoparticles form aggregates, which are sorbed on zeolite inhomogenously with some free active surface of zeolite. The particles are about 15 nm in size and reveal the partial vacancies ordering as documented through the increased ratio of tetrahedral and octahedral positions being of 1/3. FC\ZFC curves confirm strongly interacting superparamagnetic particles with a blocking temperature of 230 K.