Summary

of Agnieszka Klimek PhD thesis "Chemically modified bentonites from the deposit in Kopernica (Slovakia) as a new type of sorbents, decolorizing earths and organomineral composites "

The doctoral dissertation is devoted to determining the mineralogical and physicochemical characteristics of industrial bentonites from Kopernica and their chemically modified forms.

The results of the conducted mineralogical studies revealed that montmorillonite is the main smectite mineral of bentonite from Kopernica. It is montmorillonite containing hydrated calcium cations in interlayer spaces. Part of the layer charge comes from the tetrahedral sheet.

This bentonite was subjected to chemical and thermal modifications, as a result of which titanium, zirconium and titanium-zirconium nanoclasters, so-called pillars, were generated in the interlayer space of montmorillonite, leading to the evolution of micro- and mesoporous nanomaterials. The study demonstrated that formation of homogeneous titanium-zirconium pillars depends primarily on the pH maintained during pillaring.

Prepared materials were investigated for the ability to sorb CO_2. In this aspect, the study of CO_2 sorption on montmorillonite containing in the interlayer spaces titanium-zirconium pillars, and demonstrating its superiority with respect to titanium-only or zirconium-only pillars, is a novelty. The use of thermal analysis, together with the analysis of gas products, to estimate the amount of bound CO_2 and temperatures at which it is removed from pillared montmorillonites during their heating is also an original idea.

Another method modifying the physicochemical properties of montmorillonite was the use of a new, hybrid, thermo-chemical method of activating montmorillonites, consisting in preheating followed by incipient wetness impregnation with aqueous solutions of sodium carbonate or acids, which enabled very quick preparation of a dry product with the desired properties. The mechanisms of these processes have been described in detail.

The results of this innovative research have expanded knowledge of methods and mechanisms for the chemical modification of clay minerals and have indicated the potential for their practical applications.