Thermal Characterization of Poly(styrene sulfonate)/Layered Double Hydroxide Nanocomposites

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Abstract: Phase and morphological changes during thermolysis of $Mg_4Al_2(OH)_{12}CO_3 \cdot nH_2O$ and $Zn_6Al_2(OH)_{16}CO_3 \cdot nH_2O$ layered double hydroxides (LDH) and their nanocomposites with poly(styrene sulfonate) (PSS) are studied by X-ray powder diffraction (XRD), scanning and transmission electron micrography (SEM and TEM) and thermal analyses. $Mg_4Al_2(OH)_{12}CO_3 \cdot nH_2O$ and $Mg_2Al(OH)_6[CH_2CH(C_6H_4SO_3)] \cdot 3H_2O$ show comparable thermal stabilities: the layered structure is lost above 300 °C with the nucleation of the MgO phase at approximately 400 °C and the $MgAl_2O_4$ phase at approximately 800 °C $Zn_3Al(OH)_8[CH_2CH(C_6H_4SO_3)] \cdot nH_2O$ undergoes complete oxidative pyrolysis of the polyanion by 500 °C. Crystalline oxide products are obtained at a temperature approximately 300 °C lower than that of thermolysis of $Zn_6Al_2(OH)_{16}CO_3 \cdot nH_2O$. The SEM and TEM images show that the thermolysis of LDH carbonates produces dense aggregates containing microcrystalline particles, whereas $Mg_2Al(OH)_6[CH_2CH(C_6H_4SO_3)] \cdot 3H_2O$ forms a macroporous solid.

Key Words: Layered Double Hydroxides • Nanocomposites • Poly(styrene sulfonate)

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