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TG-MS ANALYSIS OF THE DESORPTION OF ALKYLAMMONIUM IONS FROM SMECTITES WITH DIFFERENT IRON CONTENTS AND LAYER CHARGE

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The demonstrated improvements in mechanical and barrier properties together with the increased thermal stability of clay-based nanocomposites has attracted considerable attention. For example, it has been shown that the addition of just 5wt% organoclay into polypropylene offers the same mechanical properties as the addition of 30–60wt% talc. Moreover, the overall thermal decomposition of the clay containing nanocomposite is enhanced. Unfortunately, the time to ignition (TTI) for the nanocomposite is often shorter than that of the virgin polymer but this can be remedied by the addition of conventional fire retardants at lower levels than those needed for the pristine polymer. This significant enhancement of the thermal stability of clay-based nanocomposites has led to a number of informative investigations into the thermal stability of the organoclay utilised in their production.

To date there has been no systematic study designed to correlate the relationship between the length of the alkyl chain on the surface modifying surfactant, the layer charge on the clay and the composition of the octahedral sheet. Here we use thermogravimetry-mass spectrometry to identify the decomposition products arising from octyl-, decyl-, dodecyl-, tetradecyl- and hexadecylammonium ions exchanged onto four smectites of varying charge and composition. We have used two source clays; SAz–1 (a high charge smectite) and SWa–1 (a ferruginous smectite) together with Jelšový Potok (medium charge montmorillonite) and Stebno (iron-rich beidellite).

In addition to linear alkanes and alkenes, a number of cyclic and aromatic compounds were produced by all the organoclays. The thermal decomposition of clay-organic complexes prepared using the shorter alkylammonium chains reached a maximum at lower temperature than those prepared using the longer chain species. The temperature and quantities of different desorbing species exhibited an element of correlation with the iron content in the clay structure.