

## Thermal analysis of coal-bearing strata kaolinite/potassium acetate intercalation complexes

**Hongfei Cheng and Ray L. Frost\***

Chemistry Discipline, Faculty of Science and Technology, Queensland University of Technology, 2 George Street, GPO Box 2434, Brisbane, Queensland 4001, Australia. r.frost@qut.edu.au

Kaolinite-rich rocks are very abundant in the Permo-Carboniferous coal-bearing strata and are widely used (Liu et al., 2001). It was found that kaolinite usually existed in the upper part of sedimentary cycle, deposited vertically, which was formed in the hydrodynamic environment from powerful to weak (Ding et al., 2009). The colour of coal-bearing kaolinite is rather dark, varying from light gray to gray black to almost completely black. Therefore, most kaolinite, especially coal bearing kaolinite, should be treated to improve the whiteness. Recently, some new methods for improvement whiteness of coal bearing kaolinite have been reported (Franco et al., 2007; Franco et al., 2004), in which the coal bearing kaolinite particles were calcined after intercalated with small molecules (Frost et al., 2003). In current study, thermogravimetric analysis and infrared emission spectroscopy were used to investigate the changes in the complex of coal bearing kaolinite intercalated by potassium acetate (CK/KAc).

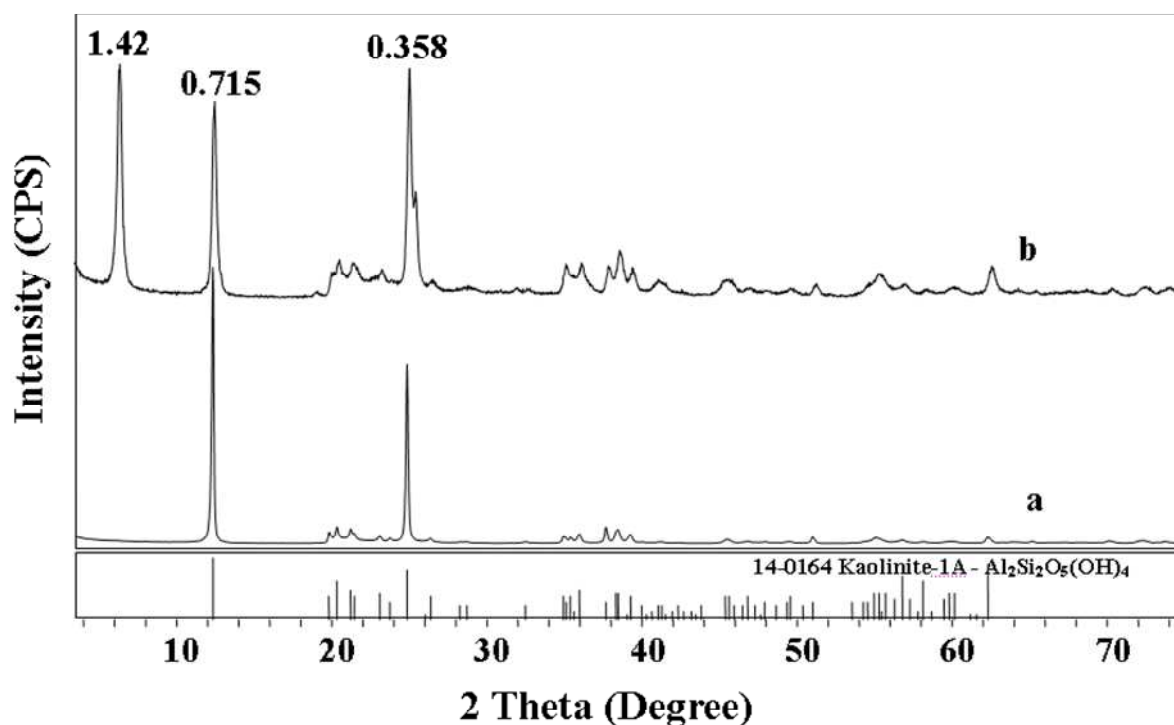


Fig. 1. XRD patterns of coal bearing kaolinite and coal bearing kaolinite-potassium acetate intercalation complex.

The XRD patterns of the coal bearing kaolinite (CK) and coal bearing kaolinite intercalation complex(CK/KAc) sample are shown in Figure 1. The CK shows an identical XRD pattern to the standard. It was observed that after CK was intercalated with potassium acetate (KAc), increasing the basal distance from 0.715 to 1.42 nm, which is consistent with the results published before (Ding et al., 2008).

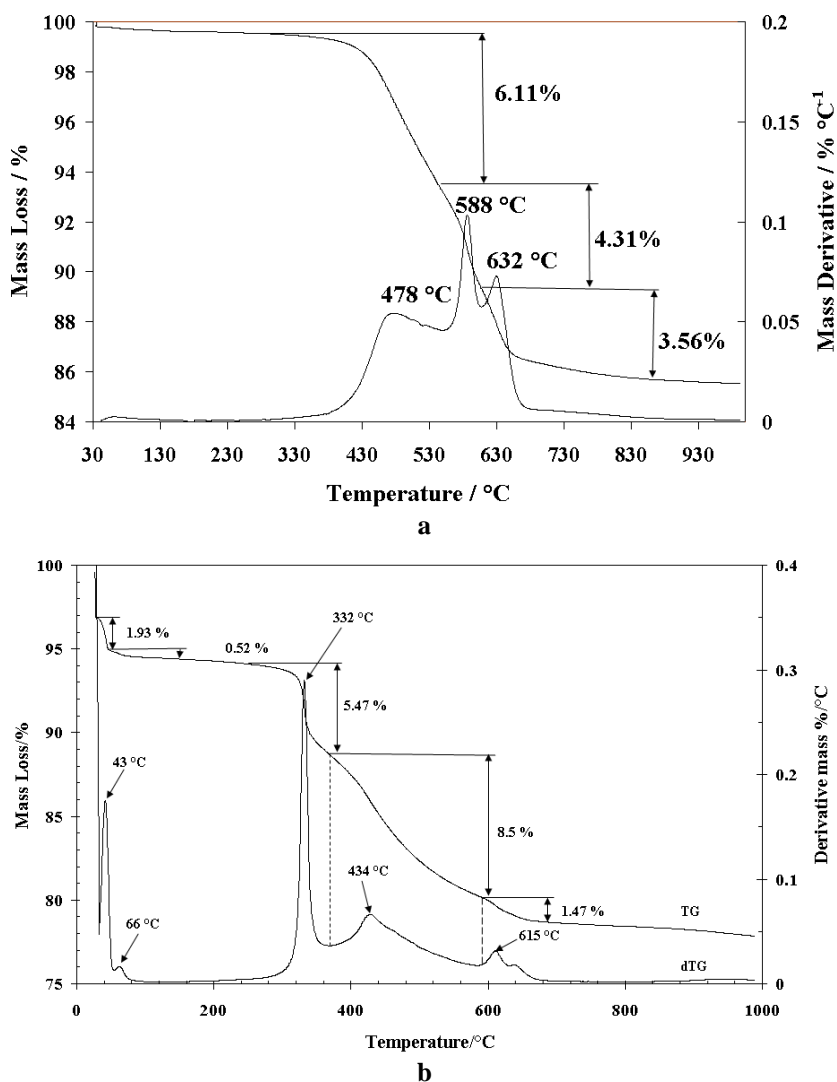


Fig. 2. TG-dTG curves of (a) CK and (b) CK/KAc.

Figure 2a shows the thermal decomposition of the CK and CK/KAc. There are three main mass losses in TG curve of CK. However, four distinct mass losses are observed in the TG-dTG curves of CK/KAc in Figure 2b. It is generally considered that a set of steps for the dehydration, loss of KAc and dehydroxylation of the intercalation complex. These steps correspond to (a) the loss of adsorbed water (b) the loss of coordination water (c) the loss of KAc and (d) the loss of water through dehydroxylation. It is clearly shown that the temperature of dehydroxylation is sharply decreased. Thus, this is benefit to the calcinations.

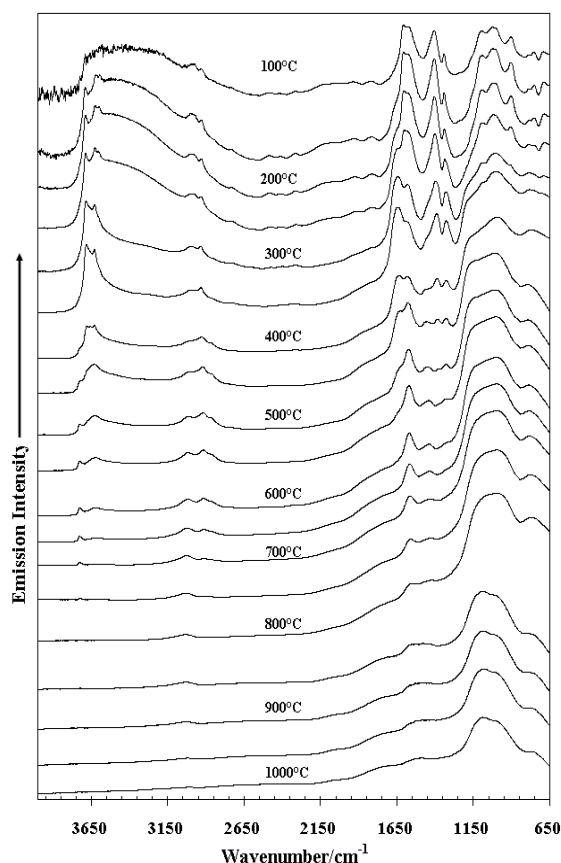


Fig. 3 Infrared emission spectra of CK/KAc.

Typical infrared emission spectra of CK/KAc are shown in Figure 3. The infrared emission spectra clearly show the decomposition and dehydroxylation of the CK/KAc when the temperature is raised. In the 200-400 °C temperature range obvious structure changes are observed. The dehydration of the intercalation complex is followed by the loss of intensity of the stretching vibration bands at region 3600-3200  $\text{cm}^{-1}$ . Dehydroxylation is followed by the decrease in intensity in the bands between 3695 and 3620  $\text{cm}^{-1}$ . Dehydration was complete by 400 °C and partial dehydroxylation by 650 °C. The inner hydroxyl group remained until around 700 °C.

## References

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