

Chapter 2

Thermal Evolution of Kaolinite

2.1 Various Method Used for Thermal Evolution of Kaolinite

Methods used by various investigators for ascertaining thermal decomposition of kaolinite are chronologically submitted in a comprehensive manner and then a summary is given. Following different experimental techniques (Table 2.1) have been chosen by various investigators using kaolinites of different localities varying in (i) degree of crystallinities, (ii) impurity oxides contents, and (iii) particle sizes, etc.

Table 2.1 Different experimental tools used to characterize phase developments in heated kaolinite

Study	Objective
1. Several physical changes—D.T.A., Dilatometry, Density, and Surface area	To ascertain the probable steps of thermal transformation of kaolinite
2. Solubility of SiO_2 and Al_2O_3 components	To reveal the nature and state of intermediate metakaolinite phase
3 Diffraction: Powder and single crystal X-ray diffraction/Electron diffraction	To identify crystalline phases formed on heating. Structural parameters e.g., unit cell dimensions of spinel, mullite, and cristobalite phases. To ascertain the phase relationship among phases
4. Microscopy: mainly electron microscopy (TEM), (HREM), and (FE-TEM)	To exhibit the morphology of parent kaolinite to heated phases and to establish interrelationships between them
5. Spectroscopy: IR, XRF, and MAS NMR	To note the changes in co-ordination number of Al among successive phases during thermal process. Simultaneously to note the changes in the character of the Si environment
6. Radial Electron Function (RED)	To correlate the theoretical RDF curves of possible transformation equations of metakaolinite to experimentally drawn RDF pattern

(continued)

Table 2.1 (continued)

Study	Objective
7. Thermodynamic approach	To calculate theoretically the changes of free energy, heat of formation, lattice energy of several possible reaction paths of kaolinite decomposition. and finally prediction there of
8. Alkali extraction of siliceous phase (A)	To estimate the amount of silica/or siliceous phase liberated during heating of kaolinite
9. QXRD	To estimate the quantities of spinel, mullite. and cristobalite phase formed during heating kaolinite
10. Alkali leaching followed by XRD, IR, HREM, EDS MAS NMR, EF-TEM, and Studies of leached residues	To evaluate the nature of intermediate spinel phase

Method used by various investigators for proper ascertaining Kaolinite–Mullite (K–M) Reaction Series are chronologically submitted in comprehensive manner in the following chapters.

Phase Transformation of Kaolinite Clay

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