Hydrous and Anhydrous Metal Formates Properties and Applications

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Hydrous and anhydrous metal formates are often used in technical processes (for example as precursors of coatings). Despite their importance, crystallographic properties of hydrous formates and their conversion to anhydrous formates are not very well understood. Therefore the crystallography and stability of metal formates hydrates must be investigated. One application is the acceleration and retardation effect of formates used as admixtures in Ordinary Portland Cement (OPC CEM I 32.5 R).

The crystallographic properties of formates were characterized by X-ray diffraction and the dehydration and decomposition reactions were characterized by thermogravimetry, Karl-Fischer-titration and high temperature X-ray diffraction. The formates were also investigated by scanning electron microscopy and optical microscopy.

The metal formate hydrates were synthesized with the highest content of water by reaction of metal carbonates, metal hydroxides or metal oxides and formic acid in aqueous solutions. The crystallization process took place at a temperature of 20°C. After synthesis of hydrates, they were dehydrated and decomposed. The properties of these different metal formate hydrates and their stability fields are very important for different applications (Viertelhaus, 2003).

The influence of metal formate solutions on the hydration behaviour of Ordinary Portland Cement was basically investigated by heat flow calorimetry (Poellmann, 1991). The systematic hydration behaviour was investigated by the addition of different concentrations of metal formate solutions (0.5, 0.1, 0.01, 0.001 and 0.0001 molar). The calorimetric studies showed some systematic relations in hydration behaviour. An acceleration of the hydration behaviour was the consequence of the addition of different calcium- and potassium formates (Raab, 2007).

Different metal formates (M = Li, Na, Mg, K, Ca, Mn, Fe, Co, Ni, Cu, Zn, Rb, Sr, Cs and Ba) and their hydrates were characterized and their potential as admixtures to cement for controlling cement hydration was determined.

References

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