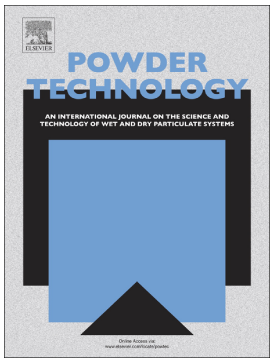

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PII: S0032-5910(18)30230-4
DOI: doi:10.1016/j.powtec.2018.03.037
Reference: PTEC 13268

To appear in: *Powder Technology*

Received date: 29 September 2017
Revised date: 7 February 2018
Accepted date: 18 March 2018

Please cite this article as: Lin Li, Meiyun Zhang, Shunxi Song, Bin Yang, Yangyu Wu, Qiang Yang , Preparation of core/shell structured silicate composite filler and its reinforcing property. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Ptec(2017), doi:10.1016/j.powtec.2018.03.037

Preparation of core/shell structured silicate composite filler and its reinforcing property

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ABSTRACT

Core/shell structured composite particles have been frequently reported to enhance the performance of products. In this work, core/shell structured calcium silicate composite filler were prepared to mitigate the negative effect of calcium silicate filler on paper strength and allow for increasing filler content in paper. Calcium silicate as the core which was used as silica source, and reacted with hydrochloric acid to form SiO_2 as shell. Results from XRD, FT-IR, SEM and BET specific surface area analysis indicated that nano-SiO_2 particles were formed on the surface of calcium silicate. The active Si-OH group on the surface of the composite filler enhanced the bondability between fillers and fibers. Physical testing of handsheets showed notable improvement in mechanical properties (tensile index increased 33.0%, tear index increased 18.1%). In addition, the Si-OH group also helped to flocculate of composite filler to larger particles, which was also beneficial to the paper strength.

KEY WORDS：Core/shell structure, calcium silicate, strength properties, filler, papermaking

1. Introduction

Core/shell structured particles are widely used in diverse areas, such as catalysis, medicine, biology and paper industries [1–6]. In decade recently, the outstanding potential of core-shell particles arises from the ability of combining more than one component chemically. Minerals are widely used in papermaking, pigments, rubber and sewage, among any others as fillers, reinforcements and adsorbents [7–11]. Mineral fillers applied in paper products mainly include precipitated calcium carbonate (PCC), ground calcium carbonate (GCC), talc and clay [12–16]. Replacing cellulose fibers with mineral filler is an economical and effective way to reduce the cost of paper products, especially for printing and writing papers [17]. In addition, some paper end-use properties, such as brightness, opacity, smoothness and printability are also enhanced [18,19]. However, the incorporation of mineral fillers in