

# Synthesis and characterization of Iron doped Calcium Silicate Hydrate nanoparticles obtained by chemical precipitation method

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Calcium silicate ceramics ( $\text{CaSiO}_3$ ) have attracted much attention in recent years due to their specific characteristics as chemical stability, bioactivity and biocompatibility allowing their use as successful material in bone tissue engineering. The incorporation of specific ions to Calcium Silicate Hydrate (CSH) can promote the modification and improvement in some properties as chemical stability, bioactivity, mechanic resistance, anti-bacterial effect, for instance [1]. CSH has showed high specific surface area that is especially desirable for drug loading and delivery systems. Iron (Fe) doped nanoparticles have been shown to have low toxicity and can be also bio-functionalized. The combination of the good properties from CSH and specific characteristics from iron ion leads this material to an exciting potential for drug delivery system as well as for contrasting agent for magnetic resonance imaging (MRI). To our knowledge, the influences of Fe ion on the formation of Fe-doped CSH particles have not been thoroughly studied, though there are some studies on the preparation of Fe- $\text{CaSiO}_3$  using TEOS[2].

In this study, we aimed to fabricate Fe doped  $\text{CaSiO}_3$  nanoparticles using a rapid and efficient chemical precipitation method and  $\text{Fe}_2\text{O}_3$  nanoparticles. The effect of the Fe content on the morphology, structure, drug loading efficiency and in vitro bioactivity of  $\text{CaSiO}_3$  has been investigated using Scanning Electron Microscopy (SEM), [Scanning Transmission Electron Microscopy](#) (STEM), FTIR and X-ray diffraction.

Preliminary results have shown the achievement of a high specific surface CSH area. According to STEM, the presence of Fe promoted some morphologic modification on the Calcium Silicate particles. The drug loading and release behavior of Fe doped calcium silicate particles and the investigation of the influence of Fe on the other characteristics of Fe doped calcium silicate hydrate are still in progress.

[1] Kaili Lin, Lunguo Xia, Haiyan Li, Xinquan Jiang, Haobo Pan, Yuanjin Xu, William W. Lu, Zhiyuan Zhang, Jiang Chang, Enhanced osteoporotic bone regeneration by strontium-substituted calcium silicate bioactive ceramics, *Biomaterials*, Volume 34, Issue 38, December 2013, Pages 10028-10042, ISSN 0142-9612, doi: 10.1016/j.biomaterials.2013.09.056

[2] Jianhua Zhang, Yufang Zhu, Jie Li, Min Zhu, Cuilian Tao and Nobutaka Hanagata, Preparation and characterization of multifunctional magnetic mesoporous calcium silicate materials. [Science and Technology of Advanced Materials](#), Volume 14, Number 5, 2013, doi:10.1088/1468-6996/14/5/055009

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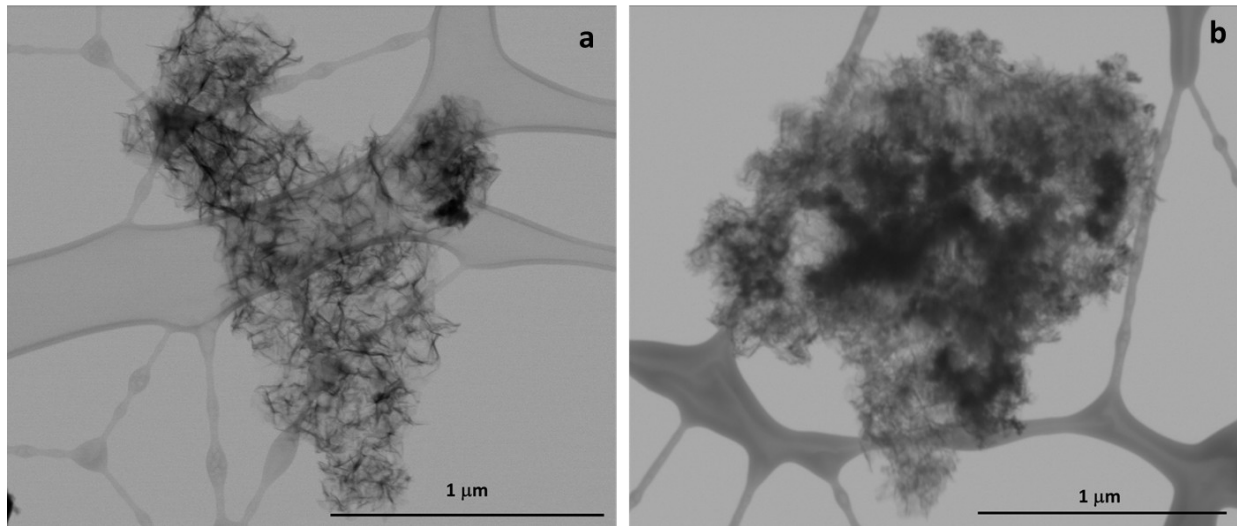


Figure 1: Scanning transmission electron micrograph of calcium silicate hydrate obtained by chemical precipitation method. (a) pure and (b) Fe-doped.