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Electrocrystallization of Calcium Carbonate ($CaCO_3$) in the Presence of Polyacrylic Acid (PAA) and Chitosan (CHI) on ITO Electrode Surface

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Extended Abstract

The biological crystallization is the process by which living organisms produce biological composites (bones, teeth, mollusk and egg shells, crustacean carapaces, etc.) and exert accurate control over the minerals they deposit, creating materials with uniform particle size, novel morphology, myriad shapes and sizes that are often high strength and remarkable properties. Therefore, natural and synthetic polymers have been used as additives and/or substrate during crystallization process of $CaCO_3$ crystals.

Herein, chitosan (CHI) and polyacrylic acid (PAA) were evaluated using an electrochemical approach for crystallization of $CaCO_3$ on ITO electrodes as working electrode. The electrocrystallization of $CaCO_3$ on ITO was performed using the procedure reported by Lédion et al. (1985). Experimental variables such as time (30 to 120 min), voltage (-890 to -600 mV) and concentration (6 to 48 mg) of PAA were evaluated. The electrocrystallization were performed on a potentiostat using an Epsilon Basi instrument. The resultant $CaCO_3$ crystals on ITO electrode were characterized by chronoamperometry response, XRD and SEM techniques.

We found that amperometric curves during the electrocrystallization showed dramatic decreases in the current values during the starting time (1-3 min) of measurement demonstrating the deposition of $CaCO_3$ particles on ITO surface. Deposition of CHI on ITO substrate showed an irregular compact surface with nanoscale protrusions of entire the ITO. In summary, CHI was efficiently electrodeposited on ITO surface and when the electrocrystallization without additive was performed only rhombohedral calcite crystals (control) with 10 µm in size was obtained. Nevertheless, when PAA and CHI/PAA were use as template perfectly round spherulitic plate with *ca*. 4 µm and spherical amorphous $CaCO_3$ (ACC) with *ca*. 1-2 µm crystals, respectively were stabilized. Both, crystalline and amorphous phases of $CaCO_3$ crystals were confirmed by XRD.

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Lédion, J., Leroy, J.P., & Labbé, J.P. (1985). Détermination Du Caractère Incrustant D'une Eau Par Un Essai D'entartrage Accélère. *TSM. L'eau*, 80, 323-328.

Mann, S., Ozin, G.A. (1996). Synthesis Of Inorganic Materials With Complex Form. *Nature,* 382(6589), 313-3188.

Neira-Carrillo, A., Acevedo, D., Miras, M., Barbero, C., Gebauer, D., Cölfen, H., & Arias, J.L. (2008). Influence Of Conducting Polymers Based On Carboxylated Polyaniline On *In Vitro* $Caco_3$ Crystallization. *Langmuir 24,* 12496-12507.