Periodic mesoporous organosilicas for drug delivery

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Abstract

A novel class of organic–inorganic nanocomposites known as periodic mesoporous organosilicas (PMOs) has been introduced in 1999. The organic functional groups in the frameworks of these solids allow tuning of the surface properties and modification of the bulk properties of the material. In PMOs, the organic groups are located within the channel walls as bridges between the Si centers ($(R'O)_3Si\text{-}R\text{-}Si(OR')_3$ (R' = methyl or ethyl, R = the bridged organic groups)). Organic–inorganic hybrid materials can be synthesized by hydrolysis and condensation reactions of bridged organosilica precursors via the self-assembly process of a structure-directing agent, corresponding to a similar process for the preparation of mesoporous silica materials. In the pioneering study of PMOs, the materials were synthesized using single bridged silane as the framework composition. In later studies, two or multiorganosilane precursors were used to obtain PMOs with multifunctional or advanced functionality. Many works reported their different functionalities, morphology and applications of PMOs, such as catalysis, drug delivery, sensing, optics, electronic devices, environmental applications (gas sensing and gas adsorption), biomolecule adsorption and chromatography, and so on. In this presentation, I will touch on the advanced applications of PMOs for drug delivery systems mainly based on our own works that have been done in recent years.

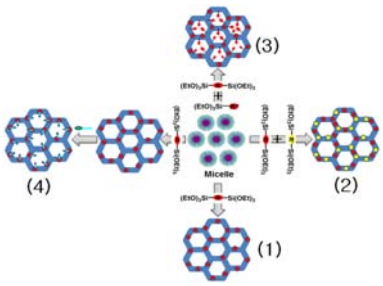


Figure 1. Four pathways for the preparation of PMOs

Recent Publications (minimum 5)

1 Hyun J, Wang S, Kim J, Rao KM, Park SY, Chung I, Ha CS, Kim SW, Yun YH, Jung Y (2016), MicroRNA-378 limits activation of hepatic stellate cells and liver fibrosis by suppressing Gli3 expression. Nature communications, 7: 10993.

2 Park SS, Moorthy MS, Ha CS (2014) Periodic Mesoporous Organosilicass for Advanced Applications. NPG Asia Materials., 6: e96; doi:10.1038/am.2014.13.

3 Mathew A, Parambadath S, Park SS, Ha C.S (2014) Hydrophobically Modified Spherical MCM-41 as Nanovalve System for Controlled Drug Delivery. Microporous and Mesoporous Materials 200: 124.

4 Moorthy MS, Park JH, Bae JH, Kim SH,. Ha CS (2014), Mesoporous Organosilica Hybrids with a Tunable Amphoteric Framework for Controlled Drug Delivery. Journal of Materials Chemistry B, 2: 6487.

5 Rao KM, Nagappan S, Seo DJ, Ha CS (2014) pH sensitive Halloysite-Sodium Hyaluronate/Poly(hydroxyethyl methacrylate) Nanocomposites for Colon Cancer Drug Delivery. Applied Clay Science 97-98:33.



Biography

Prof. Chang-Sik Ha received his B.S. in Chemical Engineering from Pusan National University (PNU), Korea (1978) and his M.S. in Chemical Engineering from Korea Advanced Institute of Science and Technology(KAIST), Seoul, Korea (1982). He obtained his Ph.D. at the KAIST in 1987. He has joined at the Department of Polymer Science and Engineering, Pusan National University as a professor since 1982. He was elected to both the Korea Academy of Science and Technology(KAST) and the National Engineering Academy of Korea(NEAK) in 2004. His research interests are Organic/Inorganic Nanohybrid Materials, and Mesoporous Materials, Funcgtional Polymers for Drug Delivery and so on.

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