

Shinshu University
GCOE Special lecture

10:00-11:00am, August 9, 2010

Silk-based Biocomposite Materials

Speaker: Dr. Juming Yao, Professor
Zhejiang Sci-Tech University
College of Materials & Textiles,

Abstract:

Recently, the significant role of organic matrices on the formation and properties of biominerals have been paying a lot of attention, such as amelogenin in tooth and type I collagen in bone, etc. Following up the inspiration derived from the biominerals, many inorganic crystals and inorganic/organic composites with specific size, shape, orientation and hierarchy have been synthesized with the surfactants, polymers and organics, some of which have a bionic structure. In our group, silk proteins, including fibroin and sericin, derived from *Bombyx mori* silkworm silk, were used as the templates to modulate the growth of hydroxyapatite (HAp) nanocrystals, by which different assemblies of HAp with silk proteins, e.g., enamel prism-like materials were obtained. Moreover, the porous HAp/silk composites were fabricated by a two-step method in order to avoid the poor dispersion of HAp due to the powder aggregation and the phase separation. The two-step method could promote the uniform dispersion of HAp in the silk matrix and provided the scaffolds with significantly enhanced compressive properties. The cell culture assay showed that the silk-based biocomposite materials could improve the cell proliferation and osteogenic differentiation, which might be important for the biomedical applications and also for the fundamental studies of inorganic-organic interactions in the body.

Contact:

Dr. Qing-Qing Ni, Professor
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About the Speaker:

Dr. Juming Yao is a Professor in the College of Materials and Textiles, Zhejiang Sci-Tech University.

Juming Yao obtained his PhD in 2003 from Department of Biotechnology, Tokyo University of Agriculture and Technology in Japan under the supervision of Prof. Tetsuo Asakura, followed by postdoctoral research on the synthesis and structural analysis of proteins at Venture Business Laboratory (TUAT). He returned to China in 2004 and he is now a professor in the College of Materials and Textiles, Zhejiang Sci-Tech University. His research interests include the design and biosynthesis of functional proteins and the protein-based composite materials.

Some papers published so far on this topic:

- (1) Li, L.; Wei, K.M.; Lin, F.; Kong, X.D.; **Yao, J.M.** Effect of silicon on the formation of silk fibroin/calcium phosphate composite. *J. Mater. Sci.: Mater. Med.*, **2008**, *19*, 577-582.
- (2) Liu, L.; Liu, J.Y.; Wang, M.Q.; Min, S.J.; Cai, Y.R.; Zhu, L.J.; **Yao, J.M.** Preparation and characterization of nano-hydroxyapatite/silk fibroin porous scaffolds. *J. Biomater. Sci. Polymer Edn.*, **2008**, *19*, 325-338.
- (3) Lin, F.; Li, Y.C.; Jin, J.; Cai, Y.R.; Wei, K.M.; **Yao, J.M.** Deposition behavior and properties of silk fibroin scaffolds soaked in simulated body fluid. *Mater. Chem. Phys.*, **2008**, *111*, 92-97.
- (4) Li, Y.C.; Cai, Y.R.; Kong, X.D.; **Yao, J.M.** Anisotropic growth of hydroxyapatite on the silk fibroin films. *Appl. Surf. Sci.*, **2008**, *255*, 1681-1685.
- (5) Du, C.L.; Jin, J.; Li, Y.C.; Kong, X.D.; Wei, K.M.; **Yao, J.M.** Novel silk fibroin/hydroxyapatite composite films: structure and properties. *Mater. Sci. Eng. C.*, **2009**, *29*, 62-68.
- (6) Cai, Y.R.; Jin, J.; Mei, D.P.; Xia, N.X.; **Yao, J.M.** Effect of silk sericin on assembly of hydroxyapatite nanocrystals into enamel prism-like structure. *J. Mater. Chem.*, **2009**, *19*, 5751-5758.
- (7) Liu, L.; Liu, J.Y.; Kong, X.D.; Cai, Y.R.; **Yao, J.M.** Porous composite scaffolds of hydroxyapatite/silk fibroin via two-step method. *Polym. Adv. Technol.* (in press) (DOI: 10.1002/pat.1595).
- (8) Cai, Y.R.; **Yao, J.M.** Effect of proteins on the synthesis and assembly of calcium phosphate nanomaterials. *Nanoscale*, (in press) (DOI: 10.1039/c0nr00092b) (invited review).

Shinshu University
GCOE Special lecture

11:00-12:00am, August 9, 2010

Fibers degrading dyes

Speaker: Dr. Chen Wenxing, Professor
Associate Vice President,
Zhejiang Sci-Tech University
Dean of Materials & Textiles,

Abstract:

Dyes in the textile industry are mainly used for fiber dyeing, and the mechanism of dyeing is the enrichment and fixation processes of dyes from solution to fiber in a very short time. In light of the above considerations, a new method, called “phase transfer *in situ* catalytic oxidation”, was demonstrated. It is based on fiber supported Metallophthalocyanine derivatives (catalytic functional fiber), and can be applied to eliminate various dyes. Because fibers have high natural affinity to dyes by physical and chemical interaction, dyes can be enriched or adsorbed onto the fiber, and be oxidized rapidly and effectively *in situ* at the surface and interior of fiber.

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About the Speaker:

Dr. Chen Wenxing is a Professor, Dean of the College of Materials and Textiles, as well as Associate Vice Dean of Zhejiang Sci-Tech University.

Education:***Ph.D. of Engineering in Functional Polymer***

Faculty of Textile Science and Technology, Shinshu University, Ueda, Japan (2000)

Ph.D. of Science in Polymer Chemistry and Physics

Department of Polymer, Zhejiang University, Hangzhou, China (1999)

Master of Engineering in Silk Engineering

Department of Silk Engineering, Zhejiang Institute of Silk Textile, Hangzhou, China (1987)

Bachelor of Engineering in Silk Engineering

Department of Silk Engineering, Zhejiang Institute of Silk Textile, Hangzhou, China (1984)

Awards and Honors:

Second Prize of the National Scientific and Technological Progress Award (2005)

State Bai-Qian-Wan Talent (2004)

Teacher in the Program for New Century Excellent Talents of the Ministry of Education (2004)

Research:

Silk Engineering

Textile Materials

Functional Polymer Materials

Publications:

More than one hundred papers have been published on many journals, such as Environmental Science & Technology, Chemical Communication, Caron, Applied Catalysis B-environmental, Journal of Colloid and Interface Science, Journal of Molecular Catalysis A-Chemical, Reactive & Functional Polymers, Dyes and Pigments, Journal of Applied Polymer Science, Textile Research Journal.