S-1

나노 구조의 인산 칼슘 세라믹과 의료목적으로의다양한 활용
(Nanostructured Calcium Phosphate Ceramics and Utilization for Various MedicalPurposes)

Kyung-Sik Oh†

School of Advanced Materials Engineering, College of Engineering Andong National University
(ksoh@andong.ac.kr†)

수산화아파타이트(HAp)나 삼인산 칼슘(β-TCP)과 같은 인산칼슘은 생체 친화성이 우수하여 골조직 재건에 효과적인 소재이다. 그 중에서도 β-TCP는 수산화아파타이트와 달리 생리조건에서 서서히 흡수되는 생분해성 물질로서 특유의 생체 친화성과 함께 적절한 나노 및 기공 구조를 도입함으로써 그 효과를 기능적으로 개선할 수 있다. 본 발표에서는 약 200~300 ㎛의 직경을 가지면서 용도에 따라 나노 기공의 상태를 조절한 β-TCP 과립을 활용하여 골조직 재생에 활용하였다. 이러한 과립상 β-TCP를 기능형의 골조직 재생용 충전재, 골조직 접합용 Bone cement 제작, 주변 조직의 견고한 결합을 도모하기 위한 경사기능 구조부여 등으로 적용한 사례에 대해 소개하였다. 또한 HAp의 생체 친화성을 활용하면서도 주변의 염증을 억제할 수 있는 기능을 부여한 Ag-doped HAp에 대해 소개하였으며 그 기능을 극대화하기 위한 나노 구조 도입, 그리고 염증 억제력이 작용하는 기간을 연장한 서방형 구조도입 사례에 대해 소개한다.

S-2

Synthesis of Ultra Low-density Nanoporous Silica Aerogel Monolith by Ambient Drying

Hae Jin Hwang†, Chul Eui Kim, Yong Chul Cha, Ji-Woong Moon*, Sub Han**, Sang-Kuk Woo**

School of Materials Science and Engineering, Inha University, Korea; *Korea Institute of Ceramic Engineering and Technology, Korea; **Korea Institute of Energy Research, Korea
(hjhwang@inha.ac.kr†)

Aerogels are highly porous materials where the pore sizes are less than a few tens nanometers in diameter. This gives a material with the highest surface area per unit weight, a high porosity (80~99.8 %), a low density (~0.003 g/cm^3), a high thermal insulation value (0.005 W/m·K), an ultra low dielectric constant (k'=1.0~2.0) and a low index of refraction (~1.05). Because of these unique properties, the silica aerogel has been extensively studied, not only for use as transparent thermal insulators but also as inter-metal dielectric materials (IMDs), optical and acoustic applications, and the space industry.

The usual production of silica aerogels includes supercritical drying and raw materials like tetraethoxysilane which prohibit a commercialization. To avoid the high costs we produced water glass based aerogel by ambient pressure drying method. This requires at least one solvent exchange from water for the surface modification. In our previous study, we have successfully fabricated a crack-free silica aerogel monolith (20 mm in diameter and 10 mm in thickness) by ambient drying method using solvents with low surface tension like hexane or xylene and TMCS/hexane mixture as a surface modification agent. The obtained aerogel monolith was sufficiently porous and had hydrophobic surfaces. However, the reproducibility of the aerogel production was dramatically reduced with increasing the diameter of the aerogel monolith.

In this study we have concentrated with improving reproducibility of water glass-based silica aerogel monolith production. The water glass-based wet gel was aged in water or TEOS/ethanol solution before exchanging the pore liquid (water) for solvent with low surface tension. Effects of the aging conditions on microstructure and density of the aerogel were investigated. Aged aerogels show a higher density and lower transmittance than non-aged aerogels, however, it is expected that the large particle size and hence pore size of the aged aerogel reduces the capillary pressure during ambient drying.

Keywords: sol-gel, hydrophobic silica aerogel, nano structure, ambient drying, water glass