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2024-Present	Full Professor, Sungkyunkwan University
2016-2024	Associate Professor Sungkyunkwan University
2012-2016	Assistant Professor, Sungkyunkwan University
2009-2011	Postdoctoral Fellow, Northwestern University

1923-2008	PhD in Materials Science, University of Illinois at Urbana-Champaign, IL, USA
2021-2023	MS in Materials Science, Seoul National University, Seoul, Korea
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Research Interests:

Nanobiotechnology, Biomaterials

1) Nucleic acid derived materials
2) Nanobiotechnology
3) Biosensors
4) AI based materials analysis

Selected Publications:

1. Monolithic DNApatite: An Elastic Apatite with Sub-Nanometer Scale Organo–Inorganic Structures. ***Advanced Materials*** 2024, 2406179. doi: 10.1002/adma.202406179.
2. Scanning Electron Microscopy Imaging of Large DNA Molecules Using a Metal-Free Electro-Stain Composed of DNA-Binding Proteins and Synthetic Polymers. ***Advanced Science***, 2024, 11 (28), 2309702. doi:10.1002/advs.202309702.
3. Automatic Quantification of Living Cells via a Non-Invasive Achromatic Colorimetric Sensor Through Machine Learning Assisted Image Analysis Using a Smartphone. ***Chemical Engineering Journal***, 2022, *450 (3)*, 138281. doi: 10.1016/j.cej.2022.138281.
4. Multifunctional Heterogeneous Carbon Nanotube Nanocomposites Assembled by DNA Binding Peptide Anchors. ***Small***, 2020, 16 (5), 1905821. doi: 10.1002/smll.201905821.
5. Statistical Characterization of the Morphologies of Nanoparticles Through Machine Learning-Based Electron Microscopy Image Analysis. ***ACS Nano***, 2020, 14 (12), 17125-17133. doi: 10.1021/acsnano.0c06809

Monolithic DNApatite: An Elastic Apatite with Sub-Nanometer Scale Organo–Inorganic Structures

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Abstract

Hydroxyapatite (HA) exhibits outstanding biocompatibility, bioactivity, osteoconductivity, and natural anti-inflammatory properties. Pure HA, ion-doped HA, and HA-polymer composites are investigated, but critical limitations such as brittleness remain; numerous efforts are being made to address them. Herein, the novel self-crystallization of a polymeric single-stranded deoxyribonucleic acid (ssDNA) without additional phosphate ions for synthesizing deoxyribonucleic apatite (DNApatite) is presented. The synthesized DNApatite, $DNA_1Ca_{2.2}(PO_4)_{1.3}OH_{2.1}$, has a repetitive dual phase of inorganic HA crystals and amorphous organic ssDNA at the sub-nm scale, forming nanorods. Its mechanical properties, including toughness and elasticity, are significantly enhanced compared with those of HA nanorod, with a Young's modulus similar to that of natural bone.

1. Monolithic DNApatite: An Elastic Apatite with Sub-Nanometer Scale Organo–Inorganic Structures. ***Advanced Materials*** 2024, 2406179. doi: 10.1002/adma.202406179