

## **NanoSUS (Ultra Fine Grained Stainless-Steel) for Orthopedic Implants**

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Musculoskeletal conditions such as low back pain, arthritis and other diseases of the joints affect millions of people around the world and are one the leading causes of disability (1). These diseases often require surgery, including total joint replacement in cases of deterioration of the natural joint (2). Serious concern regarding such procedure is the bacteria adhesion and proliferate on the surfaces of these orthopedic implants. Moreover, bacteria have shown the ability to generate resistance against drugs that once could kill them, hence, being more difficult or even impossible to eliminate them. These pathogens are the principal causative agents of two major types of infection in bone: septic arthritis and osteomyelitis, which involve the inflammatory destruction of joint and bone (3). Therefore, there is an unmet need to generate materials capable of showing reduced bacterial adhesion as well as bactericidal effect in order to avoid further health complications.

nanoSUS Bio-Tech was founded based on a collaboration between Komatsuseiki Kosakusho Co., Ltd (KSJ:Japan) and Northeastern University (NEU) in 2019. KSJ has been developing ultra-fine-grained stainless steel since 2002 (4, 5). Using this technology, we are able to control the grain size without any changes in the chemical composition of commercially available FDA approved stainless steel. On the other hand, Thomas J. Webster's lab has achieved the ability to decrease bacteria adhesion and growth with and without the use of antibiotics, for nanostructured surfaces. As an outcome of this collaboration, we were able to manufacture high strength ultra-fine-grained stainless steel with antimicrobial surface.

The global orthopedic implants market was estimated at \$45.90 billion in 2017 and is expected to reach at \$66.63 billion by 2025, registering a CAGR of 4.7% from 2018 to 2025 (6), due to the growing demand by increasing geriatric population, rising incidence of spine illness and technological advancements in this field. Based on geography, North America accounted for nearly half of the total market revenue in 2017 and is anticipated to retain its top status till 2025. At the same time, the Asia-Pacific region would cite the fastest CAGR of 6.4% throughout the study period. Based on current market trends, companies such as Zimmer, Stryker, S&N, Depuy, J&J, and Medtronic are our target customers.

Currently, we are expanding our network in the US by becoming member of Center for Disruptive Musculoskeletal Innovations (CDMI). Moreover, this project is funded through CDMI NSF program that will aid to expand the collaboration between KSJ and NEU.

The company will be established by financing from KSJ, in Boston, MA. It will manage the collaborations between academia, marketing consultants and lawyers in the US, and directors and researchers in Japan and the US. We are expecting to start our sales from the beginning of 2021.

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