

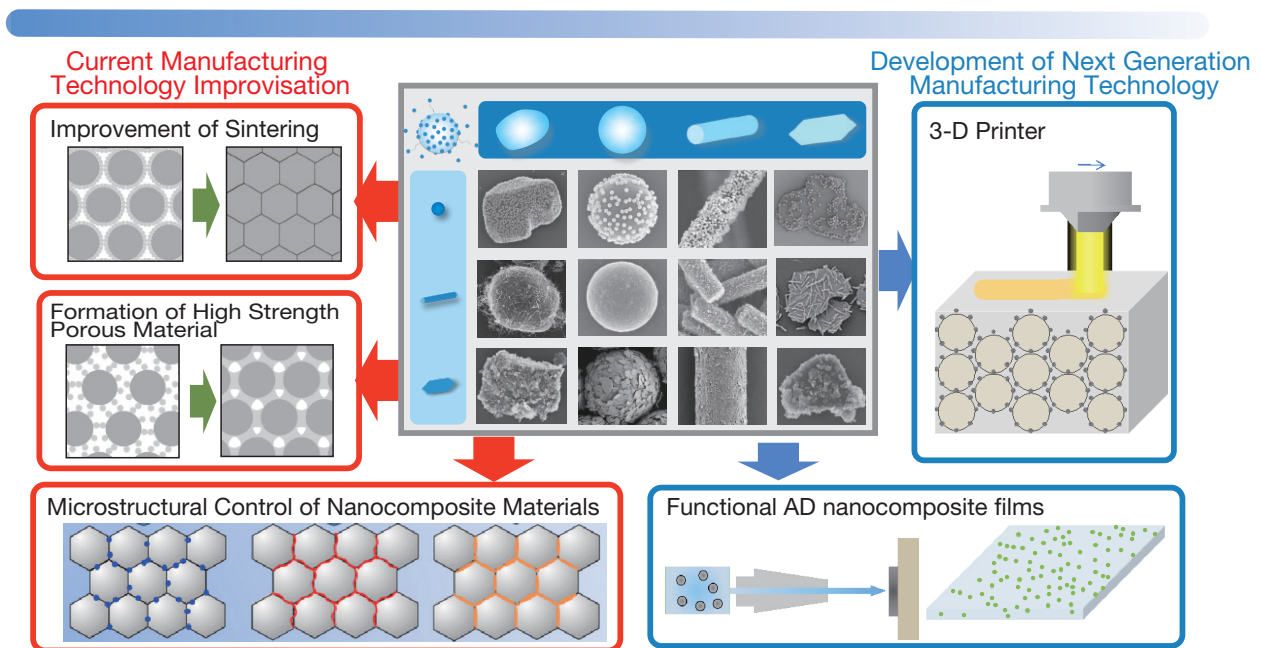
Innovative Powder Design for Next Generation Manufacturing

About this Project

■ **Next generation manufacturing will be monopolized by those who possess control of powder !**

~ Realization of Advanced Manufacturing through Innovative 'Integration' of raw powder material ~

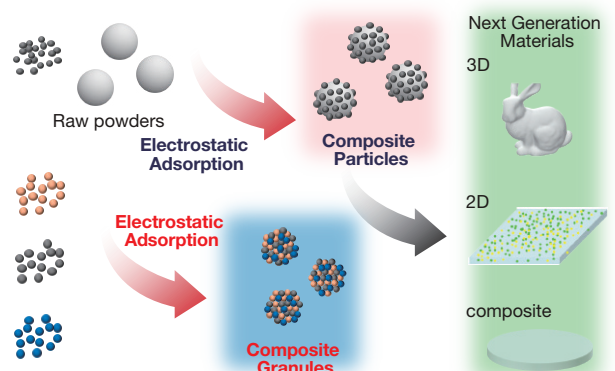
From the typically used powder metallurgical process, a novel particle design technology that could contribute towards advanced precision manufacturing using powder is being developed. Through integrated design of 'powder', unique desired properties can be achieved to overcome the current struggle in material development. This technology is expected to further develop and could be applied into additive manufacturing technology such as 3D-Printing which has attracted significant attention as a potential method for sophisticated manufacturing. In this project, the developed composite powders are used for aerosol deposition in functional composite films manufacturing as well as raw materials for 3D printing of complex-shaped ceramic manufacturing.



Test Uses / Application Examples

■ **Cost reduction in sophisticated equipment**

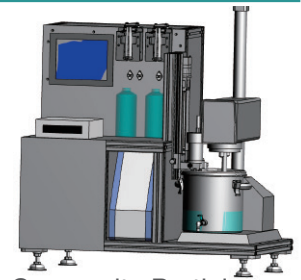
Complicated processes involved in composite particles preparation have hindered practical application. In this project, automated mass production of composite particles equipment has been successfully developed. The equipment will be set-up at Gifu Prefectural Ceramics Research Institute for joint implementation and test use purposes (~Dec 2018 onwards).



Research Achievements

Operational Composite Particles Fabrication System

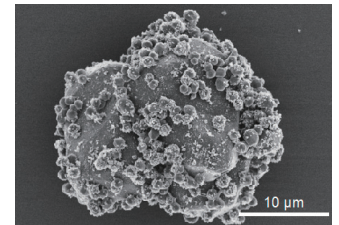
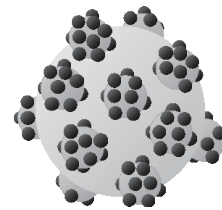
The completion of mass-production-capable composite particles fabrication system that enable supply of high quality composite materials was achieved and this would shorten the lead time in materials development. At the end of this project, commercial distribution of the composite particles fabrication system is planned as well as promotion of the research output towards mass production will be implemented. Also, establishment of a 'Composite Particle Production Platform' could be an useful base for test-use and technical support for practical implementation is scheduled.



Composite Particles Fabrication System

Now is the future of ceramics 3D printing ?!

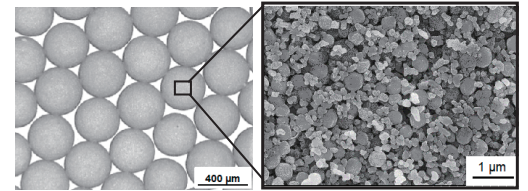
Recently, laminate-structured sintered metallic powder for 3D printing technology has been actively carried out. However, 3D ceramics fabrication is still in its early development stage. Due to the poor laser adsorption property of ceramic powder, it remains a hindrance for 3D design and fabrication. Therefore, in this work, composite particles that consisted of nanoparticles that possess excellent laser adsorption property are developed for direct laser shaping and sintering.



Ceramic composite particles for 3D Printer

Development of spherical monodisperse composite granules

Our 'integrated' composite formation technology's usage can be expanded to the formation of 'composite granules' that consist of multiple particulate components that are mixed uniformly in addition to 'composite particles'. Spherical granules with uniform-sized particles distribution could increase the complexity and variation as well as diversity in particle design that could be used in sophisticated manufacturing process.



Spherical monodisperse composite granules with homogenous particle size distribution

Future Outlook

Innovative Advanced Manufacturing using Powder

Using the established nano-assembly integration technology that we have developed, composite particles or granules can be fabricated through precise control of the particles' surface charges. Compared to conventional mixing method, high-performance functional materials could be fabricated with good reproducibility using the composite particles as starting materials due to its superior homogeneity. Therefore, the application of this technique into AD method and 3D printing technology will greatly benefit towards the realization of next-generation manufacturing technology using powder with utmost novelty and innovation.

Establishment of Networking Platform (Utilization Base)

A platform to sustain the on-going research activities at Gifu Prefectural Ceramics Research Institute will be set-up where test-use as well as research group meeting (Nanomaterial Integration technical Committee) could be held.

Gifu Prefectural Ceramics Research Institute



Research Theme : Establishment of Nanomaterial and Integrated Composite Technology for Strategic Industrial Application

Members : Toyohashi University of Technology, Gifu Prefectural Ceramics Research Institute

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Utilization Hub : Gifu Prefectural Ceramics Research Institute, Toyohashi University of Technology