

Western Tono Area

Development of Next-Generation Manufacturing Technology for Ceramic Ware

Gifu Research and Development Foundation
Technoplaza 4-179-1 Suecho, Kagamigahara City,
Gifu 509-0108 JAPAN
Tel: +81-58-379-2212



Project Promotion

Science and Technology Coordinators ... Yasushi Sasajima
Yasuhiro Hirata

Major Participating Research Organizations

Industry... Noritake Co., Limited, NGK SPARK PLUG CO., LTD., NGK INSULATORS, LTD.,
Nippon Tile Industrial Co., Ltd., MARUI CLAY AND CERAMICS KK.,
GRANDEX Co., Ltd., SHINKOYOGYO, Yamase Inc., IZAWA PIGMENT CO., LTD.,
Toho Ceramics Co. Ltd., SHIN-EI KIKO CO., LTD., YAMAAI CHINAWARE CO., LTD.,
MIZUNO KAGAKU CO., LTD.,
HOSOKAWA POWDER TECHNOLOGY RESEARCH INSTITUTE, CHUKYO YUSHI CO., LTD.,
NARITA SEITOSHO CO., LTD.
Academia... Ceramics Research Laboratory, Nagoya Institute of Technology
Government... Gifu Prefectural Ceramics Research Institute,
Tajimi City Pottery Design And Technical Center,
TOKI MUNICIPAL INSTITUTE OF CERAMICS, Mizunami City Ceramic Industrial
Technical Laboratory

Core Research Organizations

Nagoya Institute of Technology
Gifu Prefectural Ceramics Research Institute

Aim of research and development

Western Tono area is one of Japan's economic zones, known as a home for pottery making which plays a key role for the Gifu Prefectural economy. This project aims to use the research results and the network of industries, universities and government projects based on the research and development resources and potential in the region. This eventually aims to create a core industry of the region through promotion of the new ceramics industry with new technologies and activation of the sluggish conventional ceramic industry. There are two joint research themes for the next generation production technique development of pottery of the local ceramic related industry based on various porous medium production related technical seeds of Nagoya Institute of Technology and the ink-jet printing technology of Gifu Prefectural Ceramics Research Institute. Along with this project, the science and technology coordinator takes a lead to promote the research and exchange projects of industries, academia and government.

Contents of research

1. New porous ceramics production technique

Research and development are conducted for the manufacturing processes such as electromagnetic wave absorption ceramics with features of nonflammable, lightness, insulator and sound absorption, and inexpensive hollow particles, functional technologies and the evaluation techniques. As one of the approaches, the technology transfer to the local industry is aimed by practical use of those techniques such as application of a variety of pottery products and a small amount of large-scale pottery product for elderly and handicapped in the regions. This will contribute to create a new ceramics material and production techniques based on the existing production facilities or existing materials in the region.

2. Development of technology for inorganic nano-pigment particles

The aims of this study are, firstly, the elucidation of suitable synthesized conditions to obtain the nano inorganic pigments for decorating the porcelain, secondary, the estimation of the process condition to prepare the ink with the synthesized pigments for ink-jet printing, and thirdly, the fabrication of the decorated samples by ink-jet printing system using the prepared inks as its practical application.

The nano inorganic pigments are mainly synthesized by dry and wet processes such as hydrothermal synthesis and coprecipitation method. We consider how the synthesis conditions of pigments affected their coloring.

The break down process such as grinding and classification are studied as another method to obtain the nano inorganic particles. We examine the suitable grinding and/or classification conditions to obtain the nano particles for ink-jet printing. The low melting glass is used in this study.

The high-speed and fine ink-jet printing system using the inks with synthesized pigments/particles is developed for decorating on the tile and transfer paper.

The tile, transfer paper and ceramics papers are decorated by practical ink-jet printing system as the practical applications. In addition, the firing condition of the ceramics paper is studied for fast sintering.

The main study results

- 1. New porous ceramics production technique**
 - Research and development were conducted for functionality porous medium, waste raw material-based porous medium, electrically conductive ceramics and electrically conductive ceramics in a metal casing using the gelcasting method and the rapid phasing method using electromagnetic wave to establish the basic technology of the manufacturing process.
 - As the synthesis of the silica hollow particles by the bubble template approach was attempted, and a new technique of porous ceramics process using hollow particle was developed.
- 2. Developing technology of inorganic Nano-pigment particles**
 - The pigments for ink-jet printing were fabricated by the hydrothermal synthesis or the solid-state reaction and the change of the coloring of the nano-pigment particle according to various conditions was clarified. Moreover, the characteristics of glass powder prepared by various methods were estimated by the particle size distribution and the observation of particle shapes.
 - The tile and the transfer paper were decorated by ink-jet printing system with high resolution (360 dpi) using the commercially available nano pigment ink.

The large scale tile was decorated directly by the ink-jet printing system with two fluid nozzle using aqueous pigments ink, as the typical example of the large scale decorated ceramics ware such as the wall of the building.



Electrically conductive porous ceramics



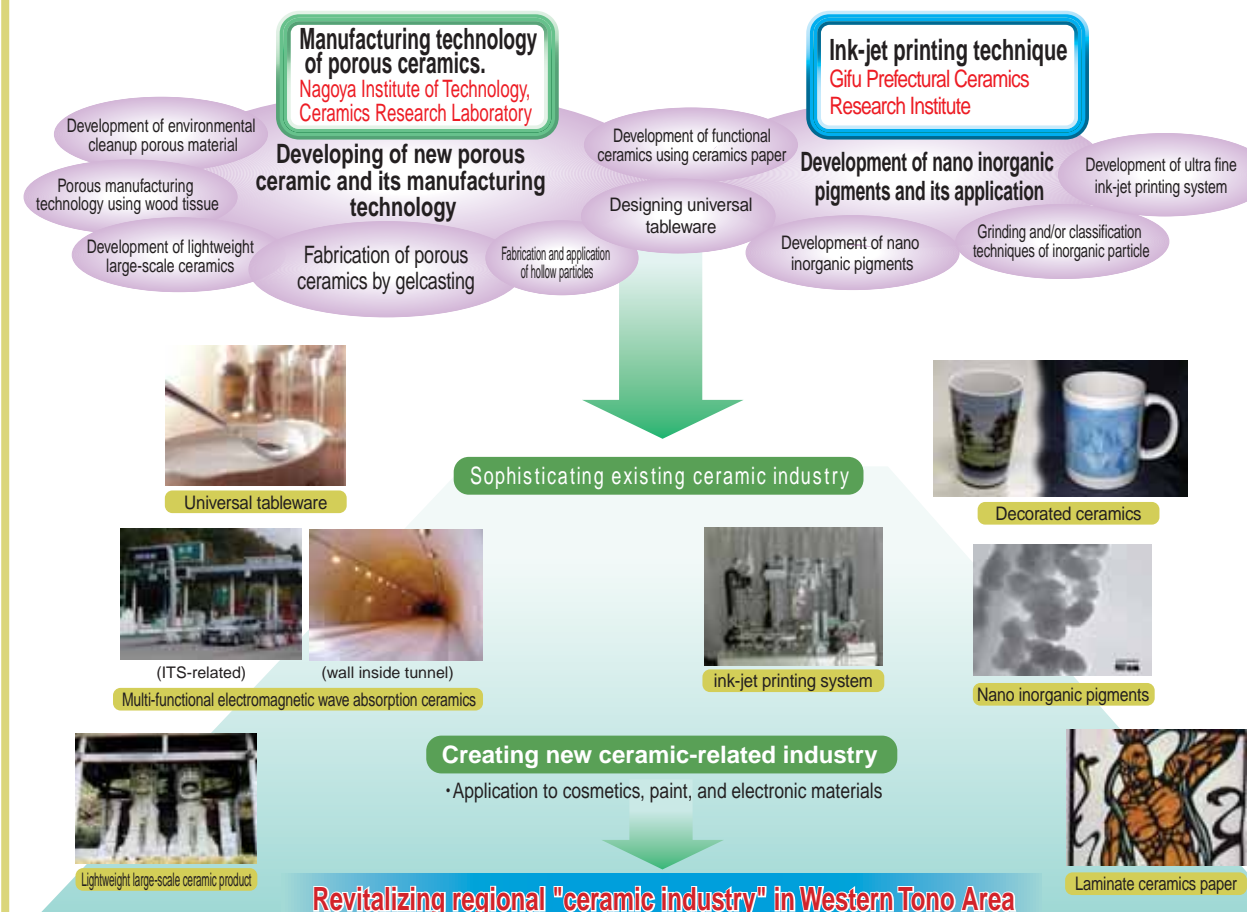
Decoration tiles on the wall of the building in Badenpark-SOGI (Sogi, Toki City), (two fluid nozzle)



Direct marking print by piezo nozzle on the refractory

Plans for Development of Next-Generation Manufacturing Technology for Ceramic

By fusing ceramic porous technology, ceramic nanoparticle synthesis technology, and ceramic ware manufacturing technology, we aim to establish next-generation manufacturing technology for ceramic ware, and hence, it will advance the existing ceramic industry, and create new ceramic-related industry.



Revitalizing regional "ceramic industry" in Western Tono Area