Name	Job Title	Area of Expertise
SANO Hideaki	Research associate	Inorganic Materials

1. Main Research Topic

① Synthesis of alloys and composites from glycol derivative metal compounds

A glycol-derived metal compound has been developed as a complementary or alternative material to conventional metal alkoxides, enabling the facile synthesis not only of pure metals and ceramics, but also of alloys and composite materials.

Generally, metal alkoxides exist as solids or liquids at room temperature and become gaseous upon thermal decomposition, which makes it difficult to control the composition and morphology of the resulting metals or ceramics. In contrast, this glycol-derived metal compound remains solid even at high temperatures during thermal decomposition, allowing for easier shape control. By adjusting the decomposition atmosphere, it is possible to selectively produce metals, carbides, nitrides, or oxides. For example, YAG:Ce^{3+} phosphor ceramics, which typically require high-temperature sintering around 1600°C, can be prepared at a relatively low temperature of 1300°C (see Fig. 1).

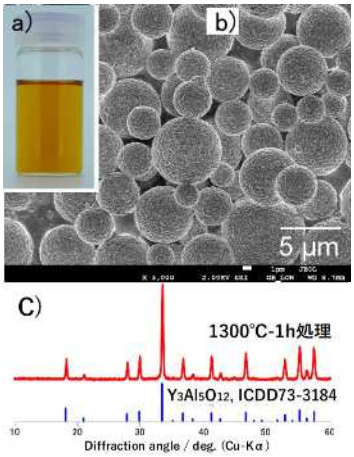

Fig.1 Prepared metal-containing glycol-derived solution (a), YAG:Ce^{3+} phosphor ceramics fabricated using porous spherical PMMA particles heat-treated at 1300℃ for 1h (b) and X-ray diffraction profile of the ceramics (c).

② Research of the efficient reaction process by interface control

We are working on efficient reaction processes to produce desired oxide and non-oxide ceramics using low temperatures and short firing times, with minimal energy. To achieve this, we are developing methods that use nitrogen-containing monomers to help reduce and nitride the materials. We are also exploring ways to improve reactions by using templates with large surface areas, which allow more effective contact between materials. This technology is being applied to areas such as dental materials and carbon materials made from biomass.

1) S. J. Shi, V. Sivasankar, K. Omine, J. Li, H. Sano and M. Ahmed. 2025. “Immobilization of Microorganisms Using Carbon Carriers – Promoting the Reduction of Cr (VI) in the Cement Leachate.” *Sustainable Materials and Technologies* **45**(March): e01478. doi:10.1016/j.susmat.2025.e01478.
2) P. Z. W. M. Moh, O. Nakagoe, N. N. Hlaing, Y. Tabuchi, K.Kamada, H. Sano, and S. Tanabe. 2024. “Role of Mn in the Ni-Mn/SBA-15 Catalyst for Hydrogen Production by Biomass Steam Reforming at Relatively Low Temperature.” *Journal of Physical Chemistry C* **128** (18): 7518–28. doi:10.1021/acs.jpcc.4c00613.
3) H. Sano, K. Omine, M. Prabhakaran, A. Darchen and V. Sivasankar, “Groundwater fluoride removal using modified mesoporous dung carbon and the impact of hydrogen-carbonate in borehole samples”. *Ecotoxicology and Environmental Safety*, **165**, 232–242 (2018). doi.org/10.1016/j.ecoenv.2018.09.001

2. Keywords

Glycol derivatives, metals / alloys, carbides, nitrides, oxides, composites, shape control

3. Remarks and Website

We actively engage in collaborative research not only with other departments and courses within the Faculty of Engineering, but also with private companies. Our main research focus is on the development of materials related to metals and ceramics, both in nano and bulk forms. Thanks to access to many shared research instruments at Nagasaki University (https://nushare.ura.nagasaki-u.ac.jp/index.php), we also conduct joint research projects that focus solely on material evaluation.

Looking ahead, we plan to build a more efficient framework for materials development using materials informatics and artificial intelligence (AI). Beyond the traditional boundaries of our laboratory, we support external research needs by utilizing the inter-university equipment network (https://chem-eqnet.ims.ac.jp/). Our current projects include the development of equipment and control/analysis software for catalytic reactions related to CO_2 fixation, as well as fatigue testing systems for dental implants.

researchmap：https://researchmap.jp/quasers/