Niterra

NEWS RELEASE

Niterra Co., Ltd.

Niterra Develops New Lead-Free Piezoelectric Materials Utilizing Materials Informatics

The cutting-edge approach allows for developing high-performance and mass-producible materials in a shorter period.

NAGOYA, JAPAN, June 13, 2024 — Niterra Co., Ltd., a leading Japanese manufacturer of spark plugs and sensors with an evolving portfolio focused on ceramics and beyond, has unveiled its latest innovation - lead-free piezoelectric materials developed using Materials Informatics (MI). This cutting-edge approach allows for high-performance and mass-production capabilities. By harnessing this method for the first time, the company aims to streamline material development and accelerate the creation of new business opportunities.

1. Background

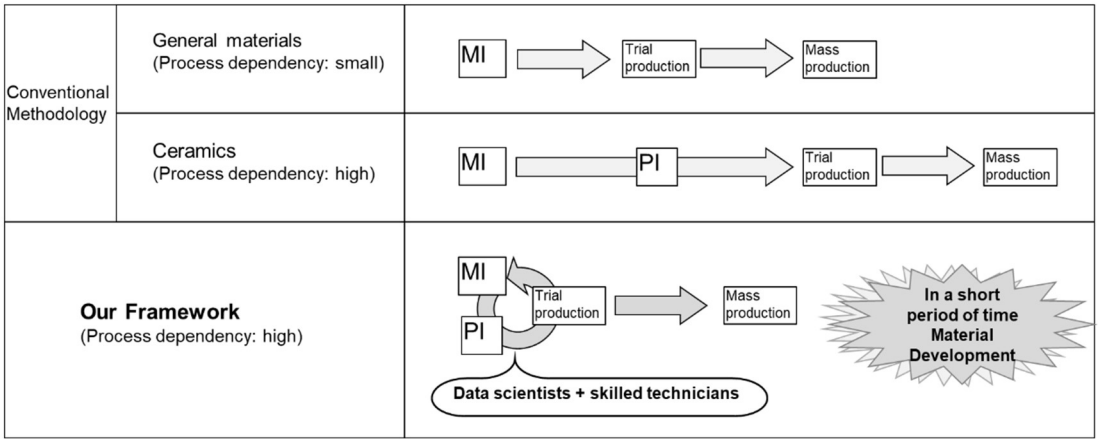
Piezoelectric materials exhibit vibrations when voltage is applied and generate electricity when pressure is applied. They are commonly used in buzzers, sensors, actuators, and other devices. Generally, traditional materials containing lead pose environmental and human health damage, so lead-free piezoelectric materials are a preferred alternative.

For over two decades, Niterra has been dedicated to research and development of lead-free piezoelectric materials, focusing on alkali niobate. However, while traditional development methods have posed challenges due to the vast array of material combinations required for material composition and process conditions, they have remained steadfast in their commitment. To overcome these challenges, they adopted a new approach, harnessing the power of the MI and collaborating with data scientists and skilled technicians, which has streamlined their material development process and significantly accelerated their development timeline.

2. The Framework Utilizing the MI Method

Using MI technology and electronic lab notebooks[*1)], Niterra consolidated their past and present data, optimizing the combinations of material composition and process conditions. Consequently, they drastically reduced the 1.26 million possible combination patterns in this development case to 550, which led to the development of new lead-free piezoelectric materials with the desired performance in six months. In this approach, data scientists and skilled technicians could work closely together, quantifying material data and on-site expertise. At the same time, small-scale production facilities allow for quick transitions to mass production.

Concept of Material Development Utilizing the MI Method



3. Characteristics of the New Lead-Free Piezoelectric Material

-Piezoelectric constant: d_{33} = 400 pC/N[*2)]
-Heat resistance: Curie temperature: Tc = 200°C
-Mass producible using the solid-state reaction method (a common ceramics synthesis method)
-Organic solvent-free fabrication process (reduced environmental impact)
-High reliability (environmental resistance and reproducibility)

4. Future Outlook

Niterra aims to bring new value to the industry through innovative material development and products and solutions that surpass customer expectations. By leveraging the established MI method, they will accelerate the development of lead-free piezoelectric materials and various cutting-edge materials for the next generation.

*1): A tool that digitizes experimental records, facilitating the centralized management and visualization of data, which were traditionally managed individually. It is user-friendly, even for skilled technicians in the chemical field, and enables quick data sharing with data scientists.

*2): In accordance with JEITA EM-4501.

About Niterra

Founded in Nagoya, Japan in 1936, Niterra Co., Ltd. (formerly NGK SPARK PLUG CO., LTD.) is renowned for its NGK-branded spark plugs and NTK-branded ceramic products. Niterra, a coined word combining the Latin words "niteo" (shine) and "terra" (Earth), was introduced in April 2023 to express the reborn company's commitment to sustainability through an evolving portfolio focused on ceramics and beyond. Under the corporate message "IGNITE YOUR SPIRIT," Niterra is now expanding into the growth fields of mobility, healthcare, environment and energy, and communications. The company's consolidated revenues in fiscal 2023 (to March 2024) totaled 614.4 billion yen (4,389 million USD). Niterra has 32 bases in Japan and 61 overseas, and approximately 16,000 employees worldwide. Please visit https://www.ngkntk.co.jp/english/.