



## Material research by tailor-made (Materials Science Laboratory)

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**Research Fields** Material Science, Mechanical materials, Metal, Ceramics, Polymer

**Keywords** Powder Metallurgy, Additive Manufacturing, Cavitation Processing

- Tailor-made materials research that matches your needs (Design, fabrication, processing, proposal, analysis, etc.)

### 1. A study of creation and mechanical properties of boride-based ceramics

We create the hard and strong boride-based ceramics, mainly titanium diboride, and characterize the fabricated samples. In the field of powder metallurgy, non-oxide ceramics are roughly classified into hard-to-sinter materials. Therefore, it is difficult to obtain a high-density sintered body without the addition of a sintering agent or a bonding metal. In order to obtain a high density sintered body, we investigate the effect of adding sintering agents and the preparation method, and aim at the application to cutting tools, bearings, and bulletproof plates for the protection of civilians.

### 2. Research and development on high damping material and processing methods

Parts (materials) of aircraft, vehicles, and precision machinery are used in environments where they vibrate. The dynamic Young's modulus (modulus of elasticity) is lower than the static Young's modulus when the material is used in a vibrating environment. This property depends on the inherent damping ability of the material. We are conduct research on crack growth and fracture of components, high attenuation materials for precision machinery, dynamic vibration absorbers, etc.

### 3. Material creation and property evaluation using metal 3D additive manufacturing technology

In recent years, metal 3D additive manufacturing technology has attracted attention as a new method for producing materials, and has been widely studied in Japan. 3D additive manufacturing technology is a molding method that enables complex shapes. Therefore, 3D additive manufacturing method is suitable for manufacturing a water pipe component having a complicated shape which cannot be manufactured by the conventional manufacturing method. In our laboratory, high performance and high functionality of materials is being studied.

### 4. Study on recycling technology of fiber reinforced plastics (FRPs)

Carbon fiber reinforced plastics have a specific strength and a specific elastic modulus about 10 times and about 7 times higher than that of steel, and are attracting attention as a lightweight material. According to the data released by the Japanese Ministry of Economy, Trade and Industry, the production of CFRP in 2020 is said to reach 140,000 tons, while the amount of waste wood is increasing. In our laboratory, research on material recycling using a new method is being conducted.

### 5. Surface modification of materials using cavitation processing technology

In our laboratory, a novel cavitation processing technique using cavitation collapse pressure and heat from ultrasonic vibration is being investigated. By using cavitation for surface modification of materials, we aim to improve various properties such as improvement of fatigue strength and corrosion resistance, refinement of powder, and improvement of photocatalytic activity (Fig. 1).

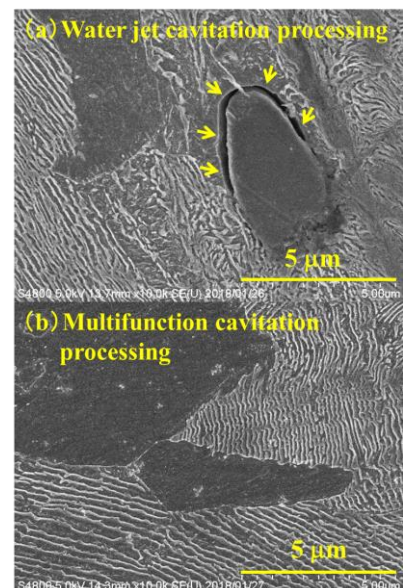


Fig. 1 Improved crack resistance of metal materials by cavitation processing.