機械学習と高エネルギー混合を活用したナノ多結晶型超伝導材料の合成

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Synthesis of Nano-Polycrystalline Superconducting Materials Using Machine Learning and High Energy Milling

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A practical application example of Materials Informatics in polycrystalline, multi-element, high-temperature superconducting materials will be reported. Polycrystalline superconducting materials have the advantage of being easier to synthesize than single-crystalline materials, but they are complex systems consisting of a network of numerous crystals and grain boundaries, making it challenging to understand and control their transport function. To address this issue, we have investigated mechanochemical synthesis using a high-energy milling method and process design incorporating machine learning [1,2].

Keywords : Machine Learning; BOXVIA; High Energy Milling; Nano Structural Analysis; Polycrystalline Superconducting Materials

多結晶型の多元系高温超伝導材料におけるマテリアルズ・インフォマティクスの実践的応用例を紹介します。多結晶型超伝導材料は、単結晶材料と比較するとより作り易い利点がありますが、無数の結晶と粒界のネットワークから構成される複雑系のため、その輸送機序理解や制御手法の確立に課題がありました。これに対し、高エネルギー混合法によるメカノケミカル合成や機械学習を取り入れたプロセス設計 [1,2]を検討したので報告します。

1) Super-strength permanent magnets with iron-based superconductors by data- & researcher-driven process design. A. Yamamoto, S. Tokuta, A. Ishii, A. Yamanaka, Y. Shimada, M. D. Ainslie, *NPG Asia Mater.* **2024**, *16*, 29 1-10.
2) Integrating Machine Learning with Advanced Processing and Characterization for Polycrystalline Materials: A Methodology Review and Application to Iron-based Superconductors. A. Yamamoto, A. Yamanaka, K. Iida, Y. Shimada, S. Hata, *Sci. Technol. Adv. Mater. (STAM)* **2025**, *27*, https://doi.org/10.1080/14686996.2024.2436347

