



# Combinatorial Investigation of Functional Oxide Thin Films

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## Laser Molecular Beam Epitaxy Chamber

(Set up summer 2005)



- Laser heating system
  - Maximum: ~1200 °C
  - Gradient: ~200 °C/cm
- UHV (<math>1 \times 10^{-9}</math>)
- RHHED (In-situ surface monitoring, atomic layer control)
- Vacuum transfer chamber (In-situ transfer to microwave microscope)
- X, Y- movable shadow masks for linear and ternary composition spread
- Multi-target system (Max. 6)

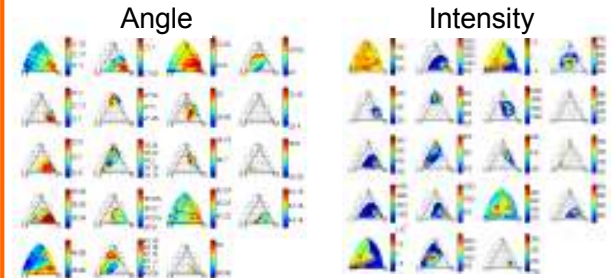
## Web based notebook for data management

(Collaboration with Tokyo Univ.)

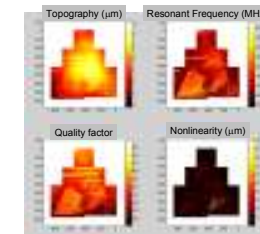


## Combinatorial investigation of Bi-Ti-Cu oxide system

Fabrication of ternary system Sample Photo

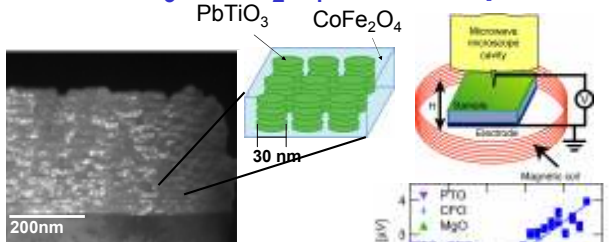


Microwave microscope mapping



Library made at Tokyo Institute of Technology

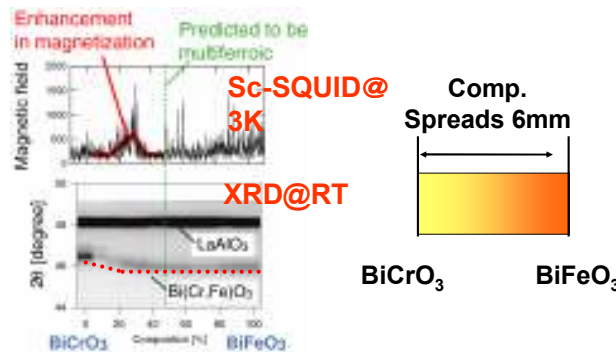
## PbTiO<sub>3</sub>-CoFe<sub>2</sub>O<sub>4</sub> nanocomposite



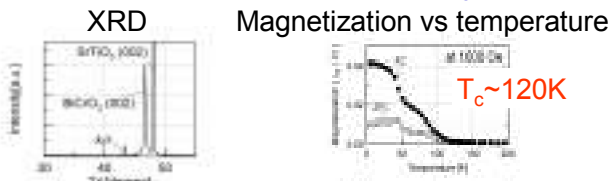
Optimum composition was identified using combinatorial techniques

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APL **87** 112901 (2005)

## BiFeO<sub>3</sub>-BiCrO<sub>3</sub> composition spread



## New multiferroic epitaxial BiCrO<sub>3</sub> thin films



Piezoelectric force microscope (PFM)



Ferroelectric!

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## Multiphase formation in BiFeO<sub>3</sub> thin films

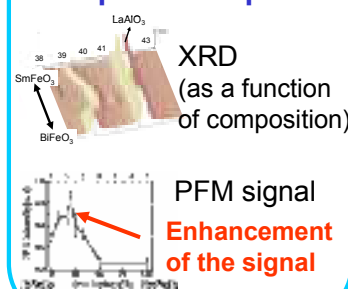
(by changing oxygen pressure during the depositions)

Plane view



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## BiFeO<sub>3</sub>-SmFeO<sub>3</sub> Composition spread



## Summary:

- We set up combinatorial laser molecular beam epitaxy chamber, which allows us to fabricate **atomic layer** controlled oxide thin films using in-situ RHEED oscillation.
- We found **new multiferroic compounds** using combinatorial techniques.
- We work on **materials informatics** in collaboration with Japanese institutes.

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