

# Chao ZHUANG

Ph.D. in Materials Science & Engineering



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## RESEARCH EXPERIENCE

### Thin Film Process for MEMS Sensors Augmentation

2021 – 2022 | National Institute for Materials Science (NIMS), Tsukuba, Japan

- **Technology Development:** Developed a Physical Vapor Deposition (PVD) protocol for MEMS sensor fabrication, yielding a six-fold improvement in sensor performance utilizing mechanical nonlinearity.
- **Sensor Testing:** Established an automated mechanical test leveraging nanoindentation, effectively standardizing MEMS sensor characterization, reducing sample variations, and streamlining the test cycle.
- **Finite Element Analysis (FEA):** Performed nonlinear mechanical analysis based on reduced order models and FEA, deriving critical specifications for methodology development.
- **Characterization:** Undertook thorough thin-film quality evaluation using SEM, wafer inspection, and stylus profilometry, facilitating metrology feedback for methodology refinement.
- **Data Analysis:** Analyzed data from a 12-channel sensor system, classifying seven agricultural samples via Principle Component Analysis (PCA) for odor-detection applications.

### MEMS Sensors Optimization via Generative Design Methods

2022 – 2023 | National Institute for Materials Science (NIMS), Tsukuba, Japan

- **Design Optimization:** Constructed density-based topology optimization models to enhance sensor performance, yielding innovative designs with a 30% performance boost within existing fabrication frameworks.
- **Script Automation:** Automated the optimization workflow with MATLAB parallelization, saving over 400 man-hours and tripling optimization throughput, remaining within budgetary constraints.
- **Documentation:** Established a comprehensive workflow reference, fostering a culture of knowledge sharing and collaborative learning within the laboratory.

### Flow Visualization Using Structural Color in Wrinkled Microfluidic Devices

2021 – 2022 | National Institute for Materials Science (NIMS), Tsukuba, Japan

- **Cross Functional Collaboration:** Conducted nonlinear mechanical analysis in the cross-functional team for a novel microfluidic device, providing theoretical insights crucial to device design and manuscript preparation.
- **Multiphysics Modeling:** Applied Fluid-Structure Interaction (FSI) simulations via FEA for experiment validation under six different gases and varying testing conditions.

## SELECTED PUBLICATIONS

- **Zhuang C.** et al. Linear Stiffness Tuning in MEMS Devices via Prestress Introduced by TiN Thin Films, ACS Applied Engineering Materials, 2023, 1 (4), 1213
- Shiba K. **Zhuang C.** et al. Visualization of Flow-Induced Strain Using Structural Color in Channel-Free Polydimethylsiloxane Devices, Advanced Science, 2023, 10 (1), 2204310

## SKILLS

### TECHNICAL SKILLS

- Design of Experiment
- Project Management
- Technology Research
- Root Cause Analysis
- Confocal Microscopy
- Nanoindentation
- Inkjet Spotter
- SEM/EDS
- Raman
- PVD
- TEM

### COMPUTER SKILLS

COMSOL • MATLAB • R  
Python • OpenFOAM  
Mathematica • LaTeX

### LANGUAGES

English • Mandarin  
Cantonese • Japanese

## AWARDS

Secured 1st place for exceptional presentation skills in English among 40 masters and Ph.D. students at academic seminars hosted by NIMS.

## EDUCATION

### UNIVERSITY OF TSUKUBA

PH.D. IN MATERIALS SCIENCE & ENGINEERING

2020 - 2023 | Tsukuba, Japan

### SUN YAT-SEN UNIVERSITY

MASTER IN MICROELECTRONICS & SOLID STATE ELECTRONICS

2016 - 2019 | Guangzhou, China

Cum. GPA: 3.3 / 4.0

### SUN YAT-SEN UNIVERSITY

BACHELOR IN MATERIALS PHYSICS

2012 - 2016 | Guangzhou, China

Cum. GPA: 3.6 / 4.0