

# Kai Narita

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## EDUCATION

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**California Institute of Technology** (CA, USA) / Sep 2016 – Present

PhD candidate in Materials Science, GPA 3.50/4.00

**Tokyo Institute of Technology** (Tokyo, Japan) / Apr 2014 - Mar 2016

Master of Engineering in Metallurgy and Ceramics Science, GPA: 3.72/4.00

**Tokyo Institute of Technology** (Tokyo, Japan) / Apr 2010 - Mar 2014

Bachelor of Engineering in Metallurgical Engineering, GPA: 3.80/4.00 (the top grade)

Completion of Global Scientists and Engineers Course

Completion of Medical Engineering Course

## RESEARCH EXPERIENCES

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**California Institute of Technology** (CA, USA) / Jan 2017 – Present

*PhD study under Prof. Julia Greer*

- Developed 3D architected carbon battery electrodes using lithography-based 3D printing and pyrolysis, which provide multidimensional form factors from micron to centimeter scales
- Characterized microstructure of 3D architected carbon and its electrochemical performance as Li- and Na-ion batteries
- Elucidated multi-scale dynamics using 3D architected carbon: effects of porous electrode architecture at micron-scale on solid electrolyte interface formation at nano-scale
- Developed catalytic graphitization of 3D architected carbon using nano-particles of transition metals incorporated by dissolving metal salts in curable resin and combustion synthesis during pyrolysis

**Max Planck Institute for Solid State Research** (Stuttgart, Germany) / May 2019 – Oct 2019

*Visiting Researcher under Prof. Joachim Maier and Dr. Robert Usiskin*

- Developed thin films of lithium oxide and lithium sulfide by radio frequency sputtering
- Characterized microstructure of air- and electron- sensitive thin films by SEM, TEM, EELS and SIMS
- Characterized transport properties of thin films of lithium oxide and lithium sulfide by electrochemical impedance spectroscopy with changing annealing conditions

**Tokyo Institute of Technology** (Tokyo, Japan) / Oct 2012 - Aug 2016

*Bachelor's and Master's Thesis Research, and research assistant under Prof. Equo Kobayashi*

- Developed Mg/ $\beta$ -tricalcium phosphate ( $\beta$ -TCP) composites by ball milling and spark plasma sintering (SPS) for orthopedic biodegradable implants
- Elucidated effects of sintering behavior involving reactions on mechanical properties of Mg/ $\beta$ -TCP composites
- Elucidated effects of *in vitro* corrosion on mechanical integrity of Mg/ $\beta$ -TCP composites
- Improved mechanical properties of Mg/ $\beta$ -TCP composites before and after *in vitro* corrosion
- Developed porous Mg/ $\beta$ -TCP composites using urea as a space holder for scaffolds in orthopedic applications

**University of Wisconsin-Madison** (WI, USA) / Sept - Oct 2015

*Visiting Researcher*, under Prof. Sindo Kou

- Investigated liquation cracking during metal inert gas (MIG) welding of Mg alloys

**University of California, Riverside** (CA, USA)/ Jul - Sept 2014

*Visiting Researcher*, under Prof. Huinan Liu

- Evaluated corrosion properties and cytocompatibility of Mg/ $\beta$ -TCP composites

**National Institute for Material Science (NIMS)** (Tsukuba, Japan)/ Mar 2014 (one month)

*Visiting Researcher* under Dr. Sachiko Hiromoto

- Investigated effects of sintering temperatures of SPS on corrosion properties of pure Mg

**NIPPON STEEL & SUMITOMO METAL** (Hokkaido, Japan)/ Aug 2012 (one month)

*Internship*

- Developed continuous cooling transformation (CCT) phase diagrams of alloyed steels

## **RESEARCH CAPABILITIES**

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<b>Material fabrication:</b>	Electroplating, Digital Light Processing (DLP) 3D printing, Sputtering, Spark plasma sintering (SPS), planetary ball milling
<b>Microstructural evaluation:</b>	Optical microscopy, laser microscopy, scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDS), electron probe micro analysis (EPMA), Transmission Electron Microscopy (TEM), X-ray diffraction (XRD), Raman spectroscopy, Secondary-Ion Mass Spectroscopy (SIMS)
<b>Mechanical evaluation:</b>	Micro Vickers hardness test, compression test
<b>Battery and corrosion evaluations:</b>	Various electrochemical measurements
<b>Biological evaluation</b>	pH meter, cell culture, fluorescence microscopy
<b>Thermal analysis:</b>	Differential scanning calorimetry (DSC), differential thermal analysis (DTA), thermogravimetry (TG)
<b>Computer:</b>	Image J, SolidWorks, GIMP, Origin, Matlab, Microsoft Office

## **SCHOLARSHIPS & RESEARCH FUNDING**

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**Masason Foundation**/ July 2017 – June 2021

-Research funding:

2,795,228 JPY ( $\approx$  25 thousands USD) in 2019.7 – 2020.6

2,281,899 JPY ( $\approx$  20 thousands USD) in 2018.7 – 2019.6

1,830,000 JPY ( $\approx$  16.5 thousands USD) in 2017.7 – 2018.6

-Full tuition and Allowance in 2019.7-2020.6

**Takenaka Foundation Scholarship**/ Sep 2016 - Aug 2019

-Tuition: 2.5 million JPY ( $\approx$  20 thousands USD) per year

-Allowance: 2 million JPY ( $\approx$  16 thousands USD) per year

**Asahi Glass Scholarship Foundation**/ Apr 2014- Mar 2016

**Tokyo Institute of Technology International Education and Research Program**/Sep - Oct 2015

**Scholarship for study abroad program**/ July- Sept 2014

## **AWARDS**

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**Best Poster Award** in the 12th Young Metallurgist Workshop/ Nov 2015

**Best Poster Award** in the Master Course Interim Poster Presentation/ Sept 2015

**Grand Prize** in EURAXESS Science Slam Japan 2014/ Nov 2014

**Excellent Student Award for Outstanding Academic Achievement**/ Mar 2014

Given to one student in each department from Tokyo Institute of Technology (undergraduate)

**The Best Presentation Award for Bachelor's Thesis**/ Mar 2014

**Nitto no Award**/ Mar 2014

Given to one student who earned the most credits in three departments related to materials science from Tokyo Institute of Technology (undergraduate)

## **HONORS**

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**Invited talk** at the 63rd Japan Society of Applied Physics Spring Meeting 2016/ Mar 2016

**Exchange program with Dalian Institute of Technology** (Dalian, China) /Mar 2013 (one week)

Honor given to top 10% of department juniors

**Special junior-year early admission to senior-year laboratory**/ Oct 2012

Honor given to top 10% of department juniors

## **PUBLICATIONS & PATENTS**

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1. Inventors: J. R. Greer, A. Vyatskikh, J. S. Thorne, A. Kudo, K. Narita, M. A. Citrin, X. Zhang; Three-Dimensional Architected Pyrolyzed Electrodes for Use in Secondary Batteries and Methods of Making Three-Dimensional Architected Electrodes/ patent applied
2. K. Narita, H. Yang, M. Citrin, X. Xia, J. R. Greer; 3D Architected Carbon Electrodes for Energy Storage/ accepted in *Advanced Energy Materials*
3. K. Narita, S. Hiromoto, E. Kobayashi, T. Sato; Degradation and mechanical integrity of magnesium-matrix composites utilizing reaction with  $\beta$ -tricalcium phosphate during sintering/ in preparation
4. K. Narita, Q. Tian, I. Johnson, C. Zhang, E. Kobayashi, H. Liu; Degradation behaviors and cytocompatibility of Mg/ $\beta$ -tricalcium phosphate composites produced by spark plasma sintering, *Journal of Biomedical Materials Research Part B: Applied Biomaterials* **2019**
5. N. Q. Cao, D. N. Pham, K. Narita, H. V. Dinh, S. Hiromoto, E. Kobayashi; In Vitro Corrosion Properties of Mg Matrix In Situ Composites Fabricated by Spark Plasma Sintering, *Metals* **2017**; 7 (9), 358
6. K. Narita, E. Kobayashi, T. Sato; Sintering behavior and mechanical properties of Mg/ $\beta$ -tricalcium phosphate composites sintered by spark plasma sintering, *Materials Transaction* **2016**; 57; 1620-7
7. N. Cao, K. Narita, E. Kobayashi, T. Sato; Evolution of the microstructure and mechanical properties of Mg-matrix *in situ* composites during spark plasma sintering, *Powder Metallurgy* **2016**;1–6
8. K. Narita, E. Kobayashi, T. Sato; Mechanical Properties Before and After in Vitro Corrosion for Mg/ $\beta$ -TCP Composites Fabricated by Spark Plasma Sintering, *Proceedings of 24th International Symposium on Processing and Fabrication of Advanced Materials (peer-reviewed)* **2015**, p. 69-78
9. K. Narita, E. Kobayashi, T. Sato; Microstructure, Initial Strength and Mechanical Integrity of Mg/ $\beta$ -TCP Composites Fabricated by Spark Plasma Sintering, *Proceedings of the Biomaterials International Conference 2015 (peer-reviewed)* **2015** (digital media)
10. K. Narita, S. Suzuki, T. Kuno; Creativity Laboratory in Metallurgy –Making Fuel Cell–, *Proceedings of AOTULE 2012 7th Student Conference* **2012**, p. 40

## **CONFERENCES / COMPETITION**

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1. **The 87th ECSJ Spring Meeting**  
(Online)/ March 2020  
Oral: 3D Architected Carbon Enables to Control Battery Electrode Structures
2. **226th Electrochemical Society meeting**  
(Atlanta, US)/ Oct 2019  
Poster: 3D architected pyrolytic carbon electrodes with multi-scale controlling factors
3. **Materials Research Society Fall meeting**  
(Boston, US)/ Nov 2018  
Oral: 3D Architected Pyrolytic Carbon as Efficient Battery Electrode
4. **9th Pacific Rim International Conference on Advanced Materials and Processing**  
(Kyoto, Japan)/ Aug 2016

Co-author: Effect of  $\beta$ -TCP Size and Porosity on Mechanical Properties of Ti-6Al-4V/ $\beta$ -TCP Composites for Biomedical Applications

**5. The 63rd Japan Society of Applied Physics Spring Meeting 2016**

(Tokyo, Japan)/ Mar 2016

Invited talk: Pursue my dream as a researcher —choice of PhD in a western country—

**6. 24th International Symposium on Processing and Fabrication of Advanced Materials**

(Osaka, Japan)/ Dec 2015

Oral: Mechanical Properties Before and After *in Vitro* Corrosion for Mg/ $\beta$ -TCP Composites Fabricated by Spark Plasma Sintering

**7. The 129th Conference of Japan Institute of Light Metals**

(Tokyo, Japan)/ Nov 2015

Co-author: Effect of Preparation of  $\beta$ -TCP on Mechanical Properties of Ti-6Al-4V/ $\beta$ -TCP Composites for Biomedical Application Before and After Dissolution of  $\beta$ -TCP

**8. The 12th Young Metallurgist Meeting**

(Kanagawa, Japan)/ Nov 2015

Poster: Microstructure and Strength Change due to Corrosion of Mg/Calcium Phosphates Composites (Best Presentation Award)

**9. Biomaterials International 2015**

(Kenting, Taiwan)/ June 2015

Oral: Microstructure, Initial Strength and Mechanical Integrity of Mg/ $\beta$ -TCP Composites Fabricated by Spark Plasma Sintering

**10. EURAXESS Science Slam Japan 2014**

(Tokyo, Japan)/ Nov 2014

-Competition of science communication skills

Oral: Na-rry Potter and Mg (Grand Prize)

**11. The 127th Conference of Japan Institute of Light Metals**

(Tokyo, Japan)/ Nov 2014

Oral: Microstructure and Mechanical Properties of Mg/ $\beta$ -TCP Composites Fabricated by Spark Plasma Sintering

**12. Asia-Ocean Top University League on Engineering (AOTULE) 2012 7th Student Conference**

(Kuala Lumpur, Malaysia)/ Nov 2012

Oral: Creativity Laboratory in Metallurgy -Making Fuel Cell-

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**LEADERSHIP ACTIVITIES & RELEVANT SKILLS**

- Mentored virtually one undergraduate in Caltech SURF program /June – August 2020
- Organized 3-days Summer Camp with visits at Caltech, UCLA and NASA-JPL for K-12 students in the Masason foundation / August 2019
- Organized study abroad support initiatives, XPLANE (<http://xplane.seldoon.net/> and 600+ participants Slack community), Pathfinders' (<https://pathfinders.hatenablog.com>) and The Japanese Graduate Student Association in the United States (JGSAU) (<https://gakuiryugaku.net/english>, and seminars) / June 2019 – Present
- Performed a science show about Mg-based bone implants research to non-scientists (Title: Na-rry Potter and Mg) and won **the Grand Prize** in the science communication competition,

EURAXESS Science Slam Japan 2014 / Nov 2014

- Volunteered The Royal Institution Christmas Lectures (Tokyo, Japan) by Professor Peter / Aug 2013

Language skills: fluent English; native Japanese