

Nilesh Badwe

Home address: 412-B Faculty Building, 4th Floor, MSE Department,
IIT Kanpur, Kanpur, UP - 208016, India

Phone No.: +91 512 259 2205
Email: nbadwe@iitk.ac.in

EDUCATION

- **Ph.D. in Materials Science and Engineering** (Nov 2014)
Arizona State University (ASU) *Dissertation: Fracture of Nanoporous Gold* GPA: 4.00/4.00
- **B. Tech. in Metallurgical Engineering and Materials Science** (May 2008)
Indian Institute of Technology, Bombay (IIT Bombay) GPA: 8.91/10.00

PROFESSIONAL EXPERIENCE

- **Assistant Professor**, Materials Science and Engineering, IIT Kanpur (Feb 2021 - Present)
- **Staff Packaging R&D Engineer & Materials Technologist**, Intel Corporation (Mar 2020 - Feb 2021)
- **Packaging R&D Engineer**, Intel Corporation (Jul 2015 – Mar 2020)
- **Post-Doctoral Research Scholar**, Arizona State University (ASU) (Dec 2014 - Jul 2015)

JOURNAL PUBLICATIONS

1. **N. Badwe**, X. Chen, D. Schreiber, M. Oltza, E. Karasz, A. Tse, S. Bruemmer, K. Sieradzki, Decoupling the role of stress and corrosion in the intergranular cracking of noble-metal alloys, **Nature Materials**, 17, 887–893 (2018).
2. **N. Badwe**, X. Chen, K. Sieradzki, Mechanical properties of nanoporous gold in tension, **Acta Materialia**, 129, 251-258 (2017).
3. **N. Badwe**, R. Mahajan, K. Sieradzki, Interfacial fracture strength and toughness of copper/epoxy-resin interfaces, **Acta Materialia**, 103, 512–518 (2016).
4. S. Sun, X. Chen, **N. Badwe**, K. Sieradzki, Potential dependent dynamic fracture in nanoporous gold, **Nature Materials**, 14, 894–898 (2015).
5. A. Vaidya, J. Zhang, O. Jin, M. Mukadam, **N. Badwe**, K. Davidson, M. Mejias, B. Palanisamy, Overview of board level underfill process as a method to improve solder joint reliability, **Intel Assembly & Test Technology Journal**, vol. 21 (2018).
6. **N. Badwe**, K. Byrd, O. Jin, S. Walwadkar, P. Goonetilleke, M. Renavikar, SAC – Sn-Bi LTS SMT hybrid joint: materials, process impact on microstructure and thermal cycle reliability, **Intel Assembly & Test Technology Journal**, vol. 21 (2018).
7. S. Cheng, S. Aravamudhan, S. Mokler, **N. Badwe**, Development of next generation solder pastes, **Intel Assembly & Test Technology Journal**, vol. 21 (2018).
8. P. Goonetilleke, **N. Badwe**, S. Walwadkar, O. Jin, D. Amir, Studies on board level surface mount technology process development, reliability, and failure analyses for a flip-chip chip scale package-on-package component, **Intel Assembly & Test Technology Journal**, vol. 20 (2017).

9. X. Chen, E. Karasz, **N. Badwe**, K. Sieradzki, Film induced cleavage in stress corrosion cracking of single crystal AgAu alloys, (In review).
10. **N. Badwe**, S. Wozny, P. Daharwal, T. Rawlings, P. Diglio, M. Renavikar, P. Tadayon, High-temperature mechanical properties and fatigue of nanocrystalline nickel - cobalt - phosphorus (NiCoP) alloy, (In review).

CONFERENCE PROCEEDINGS

1. **N. Badwe**, P. Goonetilleke, R. Sidhu, J. Stafford, Thermal cycle and drop-shock performance of homogeneous LTS vs SAC solder joints, SMTA International 2020.
2. P. Goonetilleke, **N. Badwe**, K. Byrd, M. Truong, Wetting characteristics of SnBi low temperature solder on different surface finishes, SMTA International 2020.
3. Y. Fan, T. Dale, Y. Wu, **N. Badwe**, R. Aspandiar, J. Blendell, G. Subbarayan, C. Handwerker, Intermetallic compound growth and gold embrittlement effect in Sn-Bi low temperature solders in contact with electroless nickel immersion gold (ENIG) surface finish, SMTAI International 2020.
4. **N. Badwe**, K. Byrd, O. Jin, P. Goonetilleke, Tin-Bismuth low temperature homogeneous second level interconnect solder joint microstructure, reliability, and failure mechanism, SMTA International, Chicago 2019.
5. T. Harris, K. Byrd, **N. Badwe**, Root cause and solution to mitigate the hot tear defect mode in hybrid SAC-low temperature solder joints, SMTA International, Chicago 2019.
6. A. Prasad, X. Chen, **N. Badwe**, K. Byrd, Low temperature solder paste transfer efficiency characterization and area ratio limits, SMTA International, Chicago 2019.
7. **N. Badwe**, S. Cheng, S. Aravamudhan, M. Renavikar, Solder paste: fundamental material property/SMT performance correlation, SMTA International, Chicago 2018.
8. S. Sahasrabudhe, S. Mokler, M. Renavikar, S. Sane, E. Brigham, K. Byrd, O. Jin, P. Goonetilleke, **N. Badwe**, S. Parupalli, Low temperature solder – a breakthrough technology for surface mounted devices, IEEE 68th Electronic Components and Technology Conference (ECTC), San Diego 2018.

CONFERENCE PRESENTATIONS

1. Y. Fan, Y. Wu, T. Dale, S. Achar, H. Fowler, **N. Badwe**, R. Aspandiar, J. Blendell, G. Subbarayan, C. Handwerker, Microalloying effects on intermetallic compound growth and mechanical reliability of Sn-Bi solder joints, TMS 2021
2. **Invited Talk: N. Badwe**, Future of interconnects: hybrid vs homogeneous low temperature solder joints, Advanced Microelectronic Packaging and Emerging Interconnect Materials Workshop at TMS, San Diego 2020.
3. Y. Fan, Y. Wu, J. Blendell, **N. Badwe**, C. Handwerker, A model study of Bi diffusion and intermetallic growth in Sn-Bi low temperature soldering systems, TMS, San Diego 2020
4. **Invited Talk: N. Badwe**, Low melting temperature solder and interconnects: looking back to the Bi role in Sn base solder, Electronic Packaging and Interconnect Materials Workshop at TMS, San Antonio 2019.
5. **N. Badwe**, Sn-Bi solders overview: material development, Bi supply and SMT impact, LTS Symposium at SMTAI, Chicago 2019.

6. **Invited Talk:** Y. Fan, Y. Wu, J. Blendell, **N. Badwe**, C. Handwerker, Thermodynamic and kinetic effects on microstructure evolution in hybrid low temperature solder/high-Sn solder joints, IEEE 6th International Workshop on Low Temperature Bonding for 3D Integration (LTB-3D), Kanazawa, Japan 2019.
7. Y. Fan, Y. Wu, J. Blendell, **N. Badwe**, C. Handwerker, A model study of microstructure evolution and Bi diffusion in Sn-Bi low temperature soldering systems, MS&T, Portland 2019
8. **Invited Talk:** K. Sieradzki, **N. Badwe**, X. Chen, E. Karasz, A. Tse, Dealloying induced stress corrosion cracking, TMS, Phoenix 2018.
9. X. Chen, K. Sieradzki, **N. Badwe**, Mechanical properties of nanoporous gold, MRS Spring meeting, Phoenix 2016.

BOOK CHAPTER/MAGAZINE ARTICLE

1. R. Aspandiar, **N. Badwe**, K. Byrd, Low temperature lead free alloys and solder pastes, In J. Bath (Ed.), Lead-free soldering process development and reliability, John wiley & sons inc publisher, Jul 2020.
2. **N. Badwe**, K. Byrd, O. Jin, P. Goonetilleke, Tin-Bismuth low temperature homogeneous second level interconnect solder joint microstructure, reliability, and failure mechanism, Circuit assembly magazine, Feb 2020.

RESEARCH PROPOSALS

Responsibilities: Industry mentor/liaison; Mentoring, and guiding university research along with the respective PIs

1. High melt – low melt solder interconnect structures for SMT applications, PI: Prof. E. Cotts, Binghamton University, Semiconductor research center (SRC) (2017 – 20).
2. Low temperature solder systems – development and fundamental understanding, PIs: Prof. C. Handwerker, Prof. G. Subbarayan, Purdue University, Intel System Integration Strategic Research Sector (SRS) (2018 – 21).
3. Reliable low temperature solder approach,, PIs: Prof. Borgesen, Prof. Dimitrov, Binghamton University, CHIRP Center/Semiconductor research center (SRC) (2020 – 22)
4. Development of local degradation index for thermal cycling joints based on pre-crack EBSD analysis, PI: Prof. Tae-Kyu Lee, Portland State University, Intel Corporation Funding (2020 – 21)

REVIEWER

- Acta Materialia
- Scripta Materialia
- Materials Science and Engineering A (Outstanding reviewer award)
- Journal of Electronic Materials
- Journal of SMT
- Intel Assembly & Test Technology Journal
- Semiconductor Research Corporation (SRC) - Grant proposals
- Intel System Integration Strategic Research Sector (SRS) - Grant proposals

ORGANIZATION

- **Technical Advisory Committee:** SMTAI 2020.
- **Organizer:** Adv. Microelectronic Packaging & Emerging Interconnect Materials Workshop at TMS, San Diego 2020
- **Organizer:** Low Temperature Solder Symposium, SMTA International, Chicago, 2019
- **Organizer:** Materials section, ASME InterPack Workshop, San Jose 2016
- **Session Chair:** TMS, San Antonio 2019, San Diego 2020
- **Session Co-chair:** SMTA International, Chicago 2018, 2019.
- **Event Organizer:** PAN-IIT Phoenix Chapter, 2014 - 15

AWARDS/SCHOLARSHIPS

- TMG Excellence Award, **Intel Corporation** (2018)
- ATTD and CQN Department Recognition Awards, **Intel Corporation** (2017, 2019, 2019, 2021, 2021)
- University Graduate Fellowship – **Arizona State University** (2008, 2012)
- Among top 3 students (out of 560) selected from IIT Bombay for **Tata steel scholarship** (2007 - 08)
- Among top 3 students from Maharashtra selected for **Hinduja merit cum means scholarship** (2001 - 08)