Cu Sintering BGA Interconnect for Mitigating Electromigration in High-Current AI Power Delivery

Chengjie Du, Xufu Ren

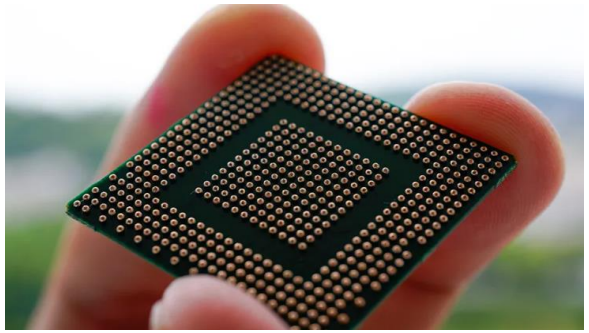
Department of Engineering, University of Cambridge

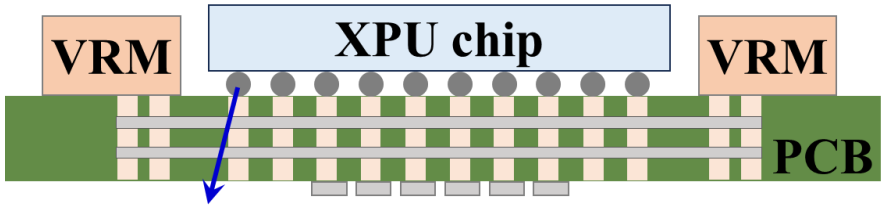


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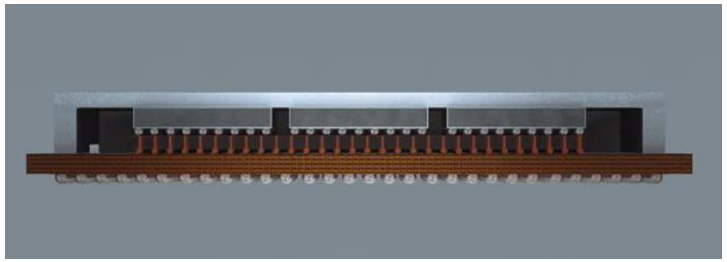
October 14, 2026
San Jose, California

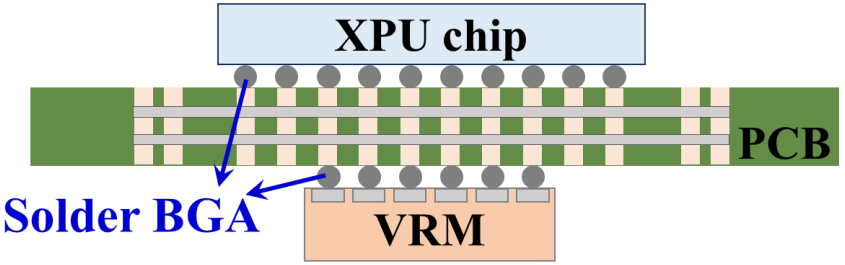
Problem Statement





Lateral power delivery

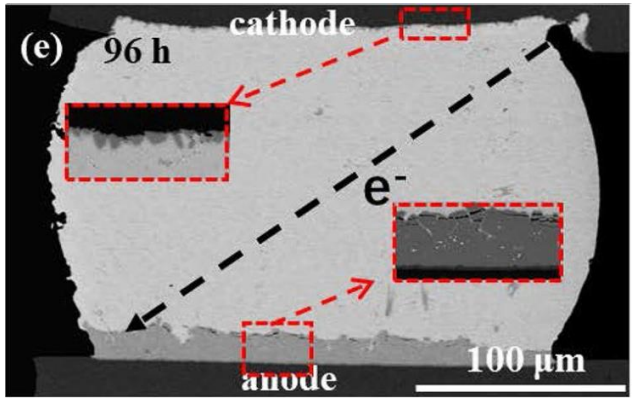


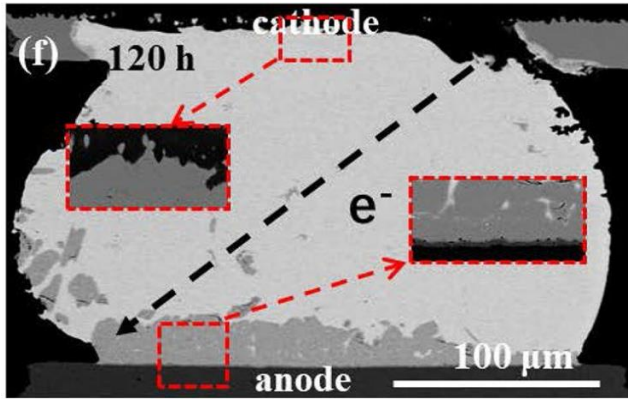


Vertical power delivery

current density expected to surpass 2 A/mm^2

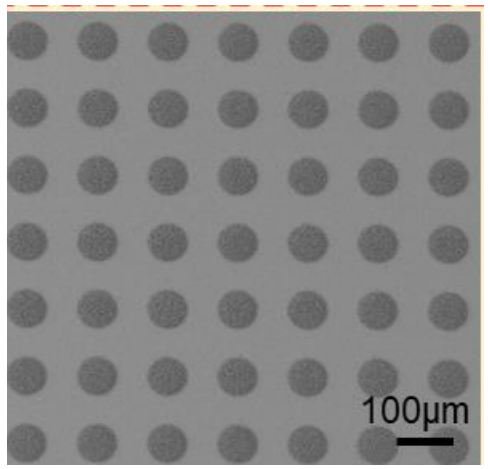
BGA application in high-current AI power delivery

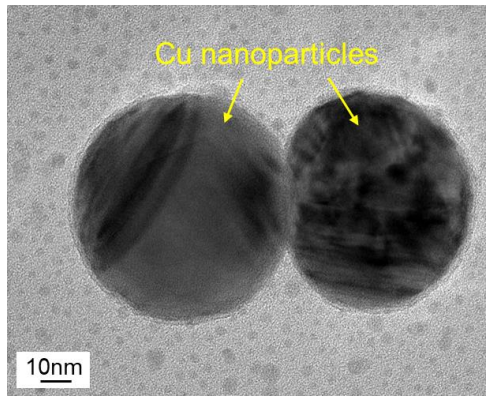




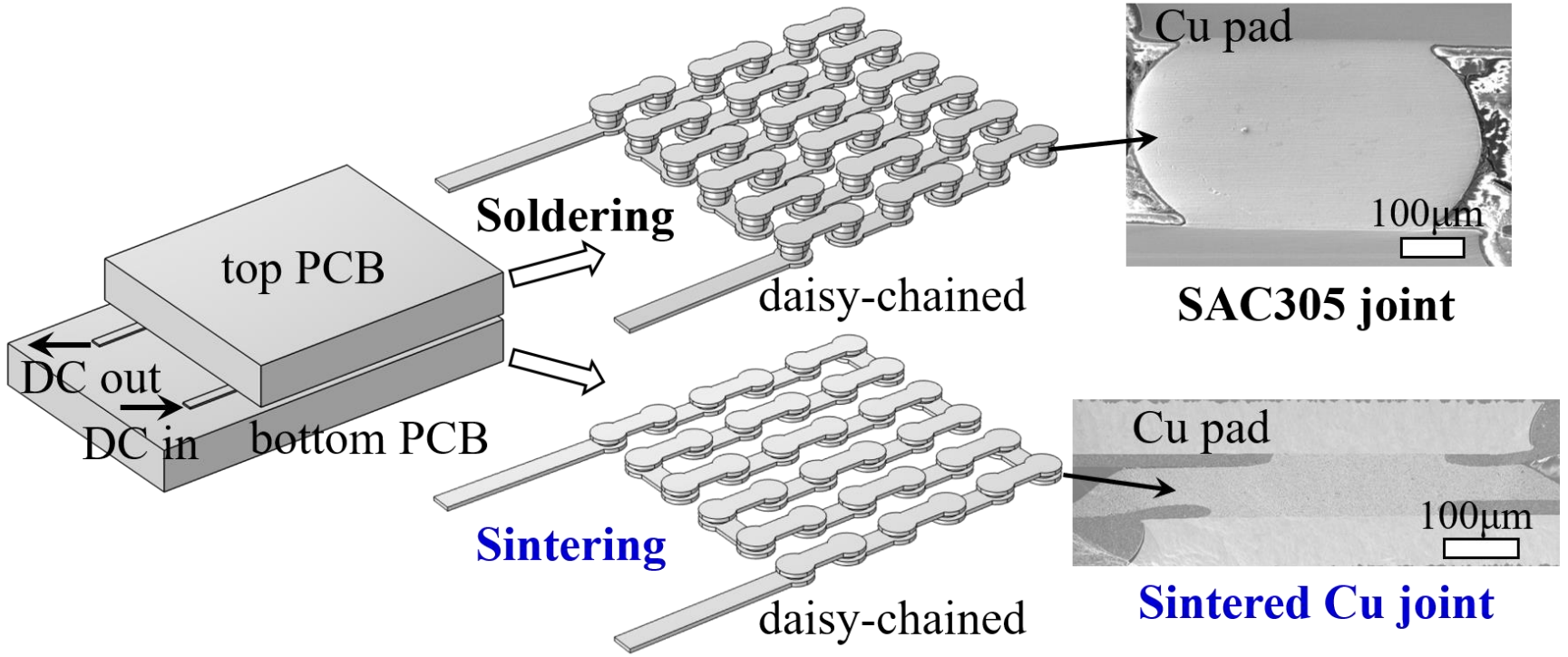
Solder: Electromigration failure

Proposed solution: Cu sintering



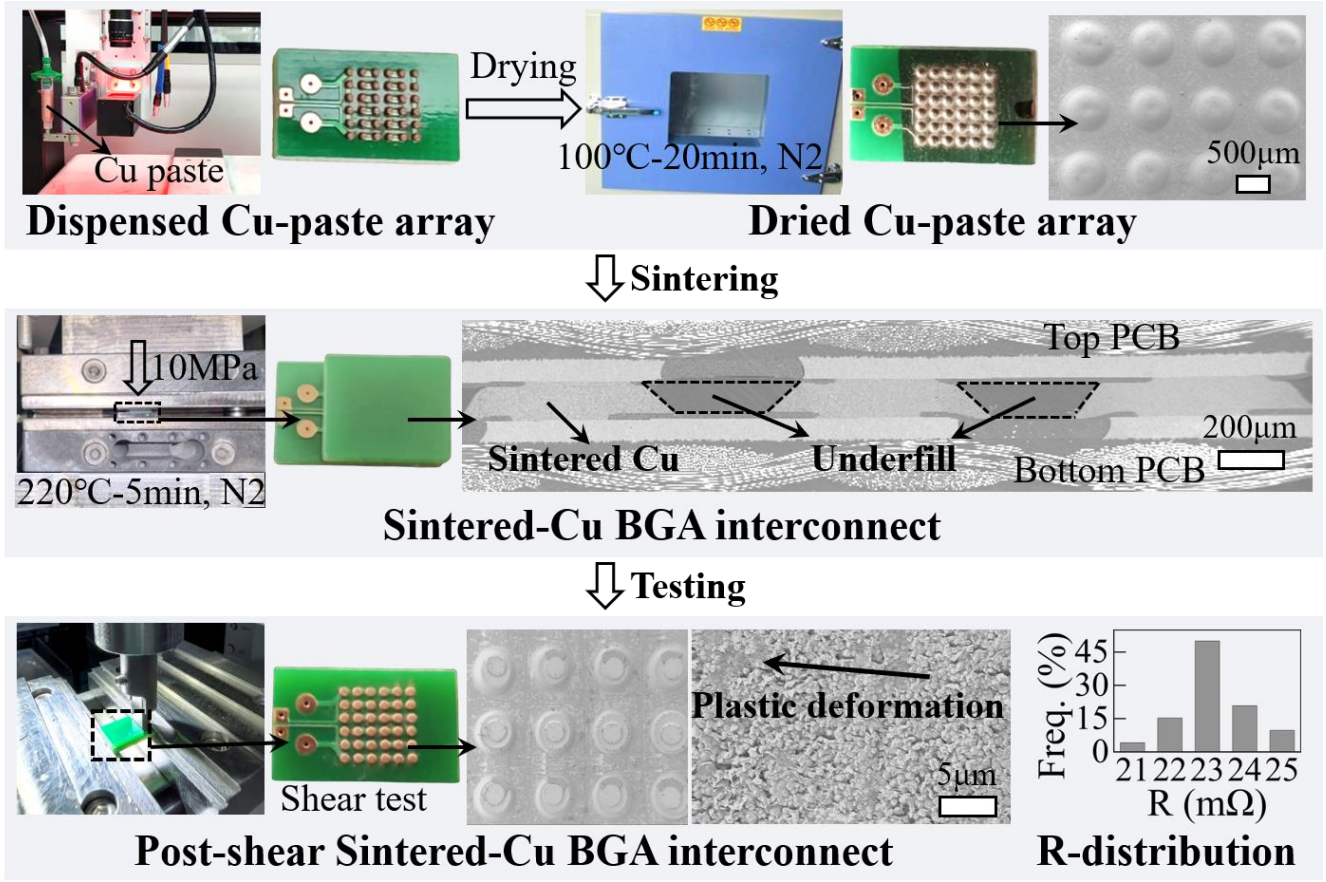


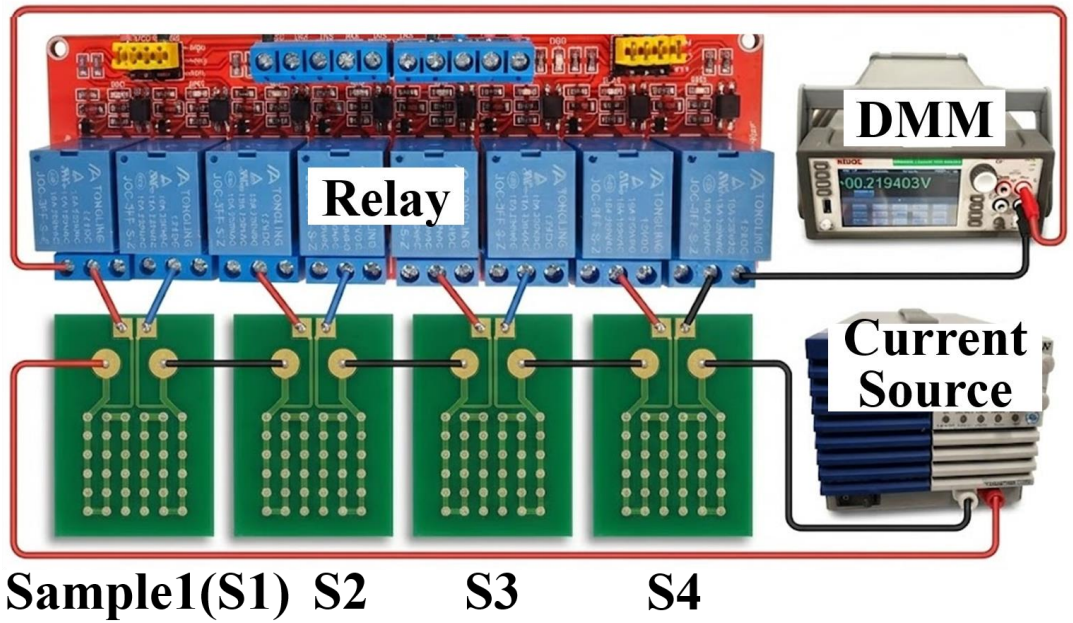
Cu nanoparticles sintering



Daisy-chained interconnects for comparing electromigration reliability of soldering and Cu sintering

Proposed solution: Cu sintering

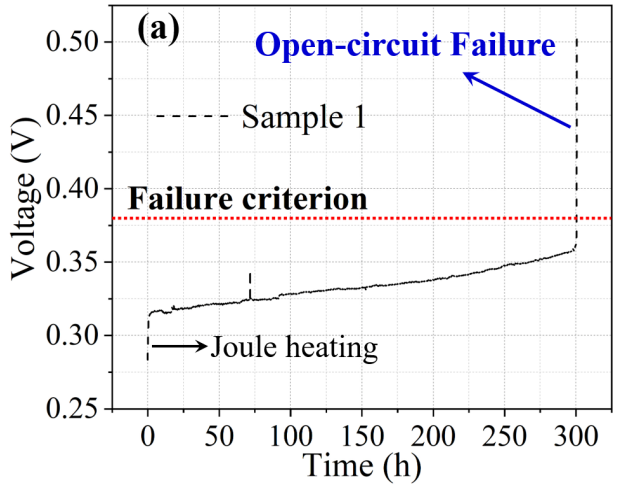


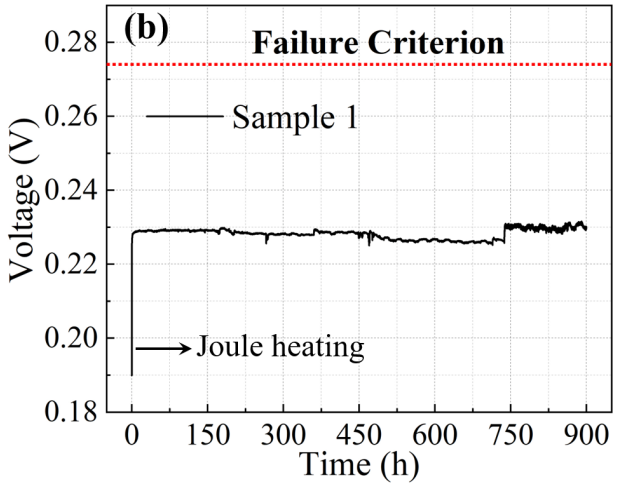


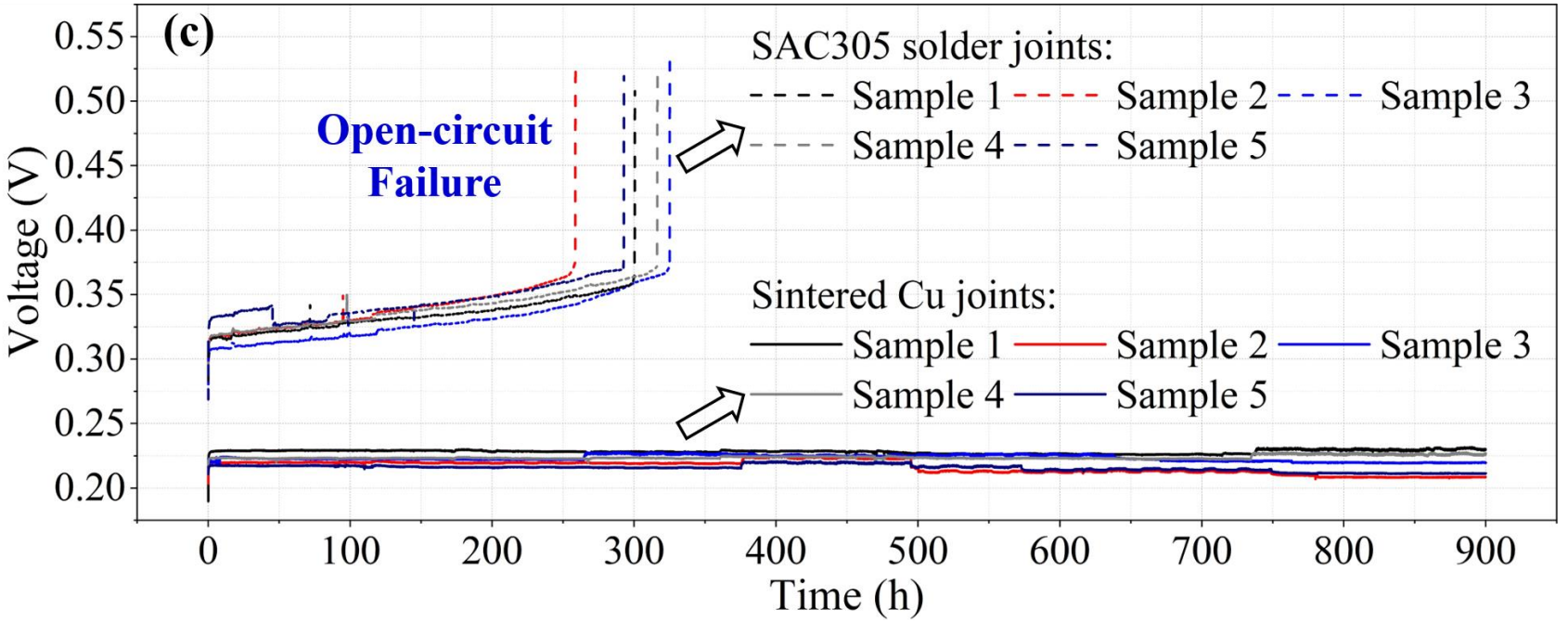
Current density: 50A/mm²

Fabrication process and performance evaluation of sintered-Cu BGA interconnect

Proposed solution: Cu sintering



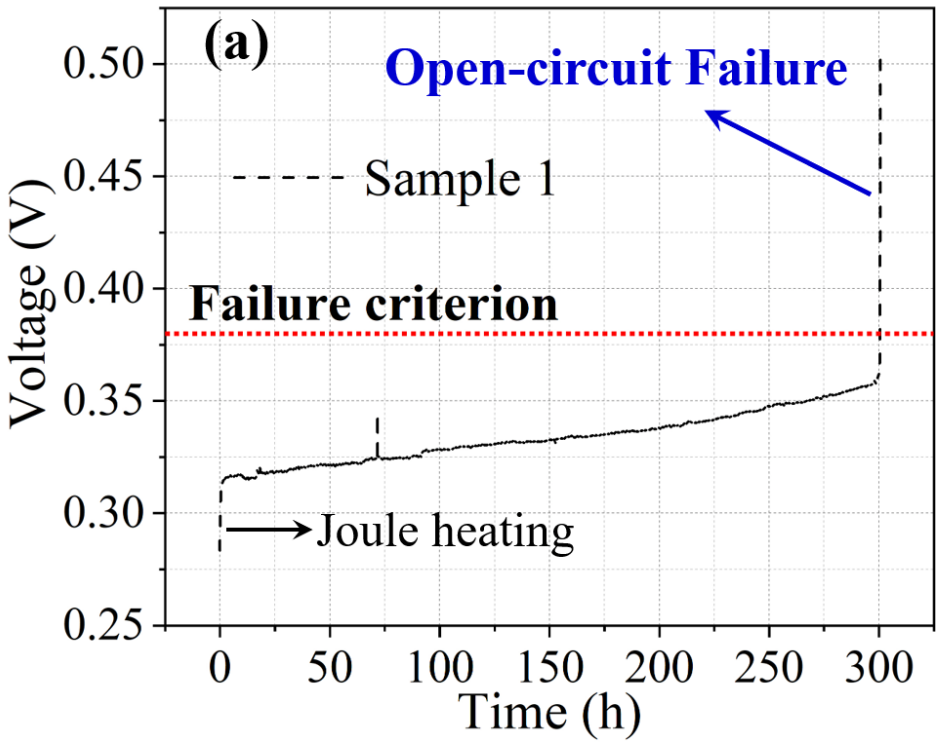


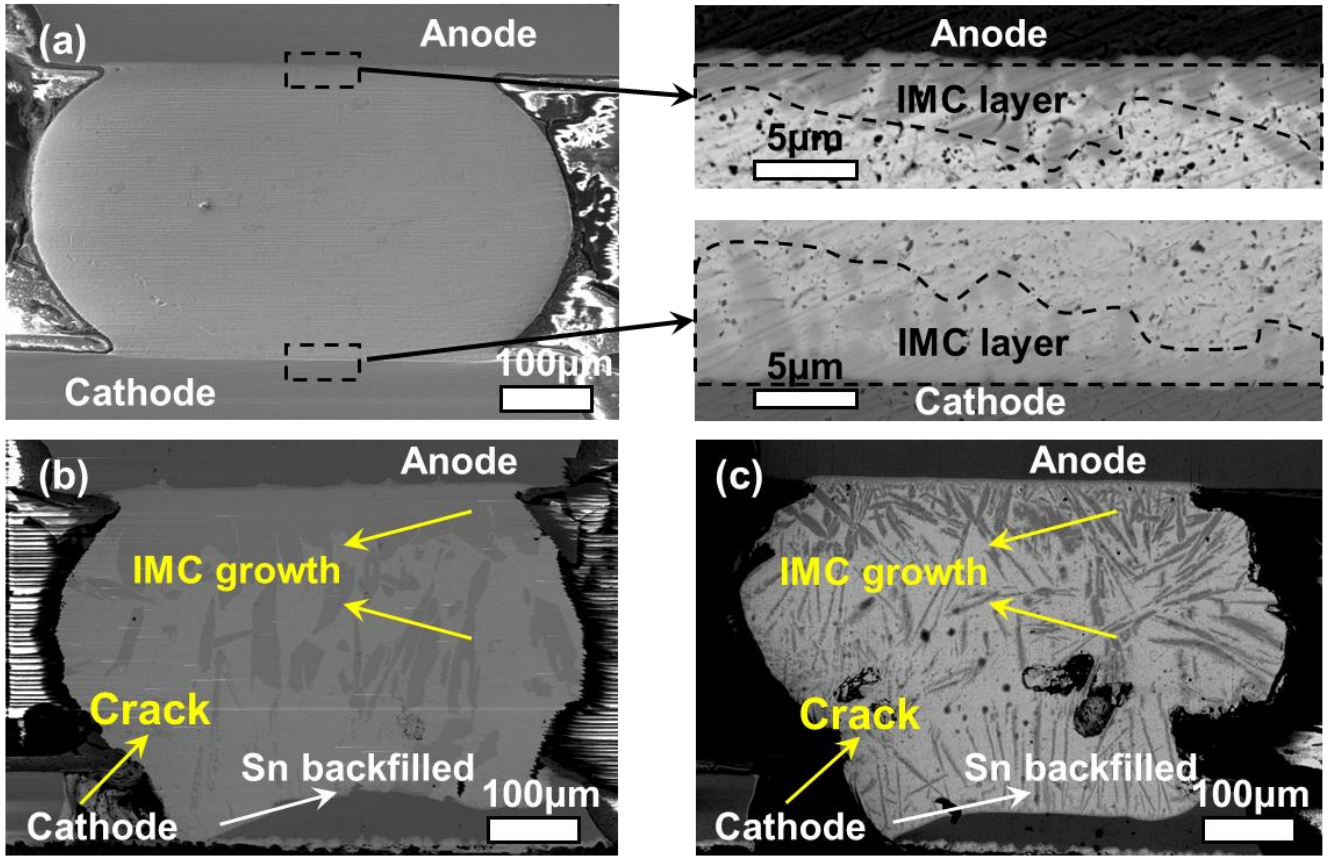


Under current density of 50 A/mm², SAC305 exhibits open-circuit failure at 300 h, Sintered-Cu BGA maintains stable electrical conduction for more than 900 h

Sintered-Cu BGA interconnects provide significant electromigration reliability improvement compared to solder-based counterpart

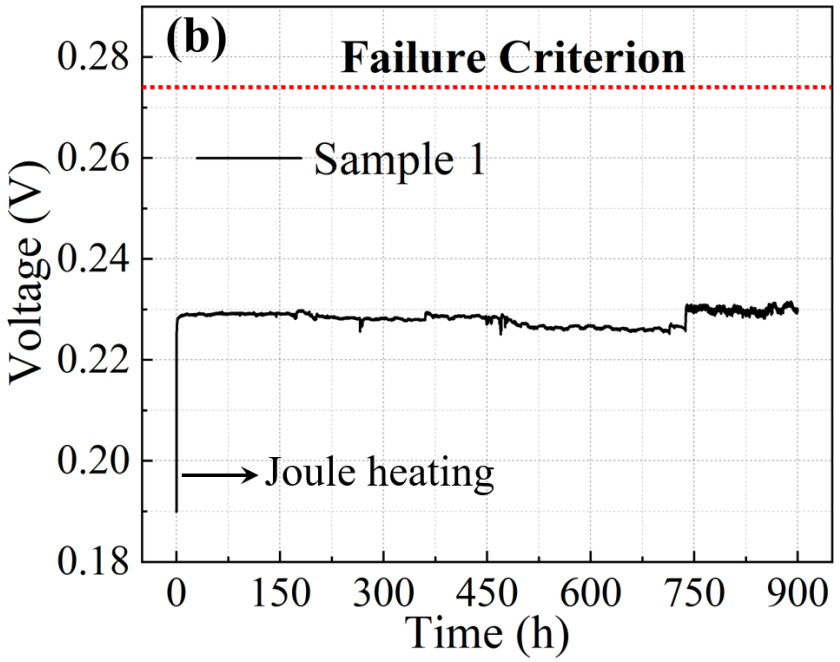
Proposed solution: Cu sintering

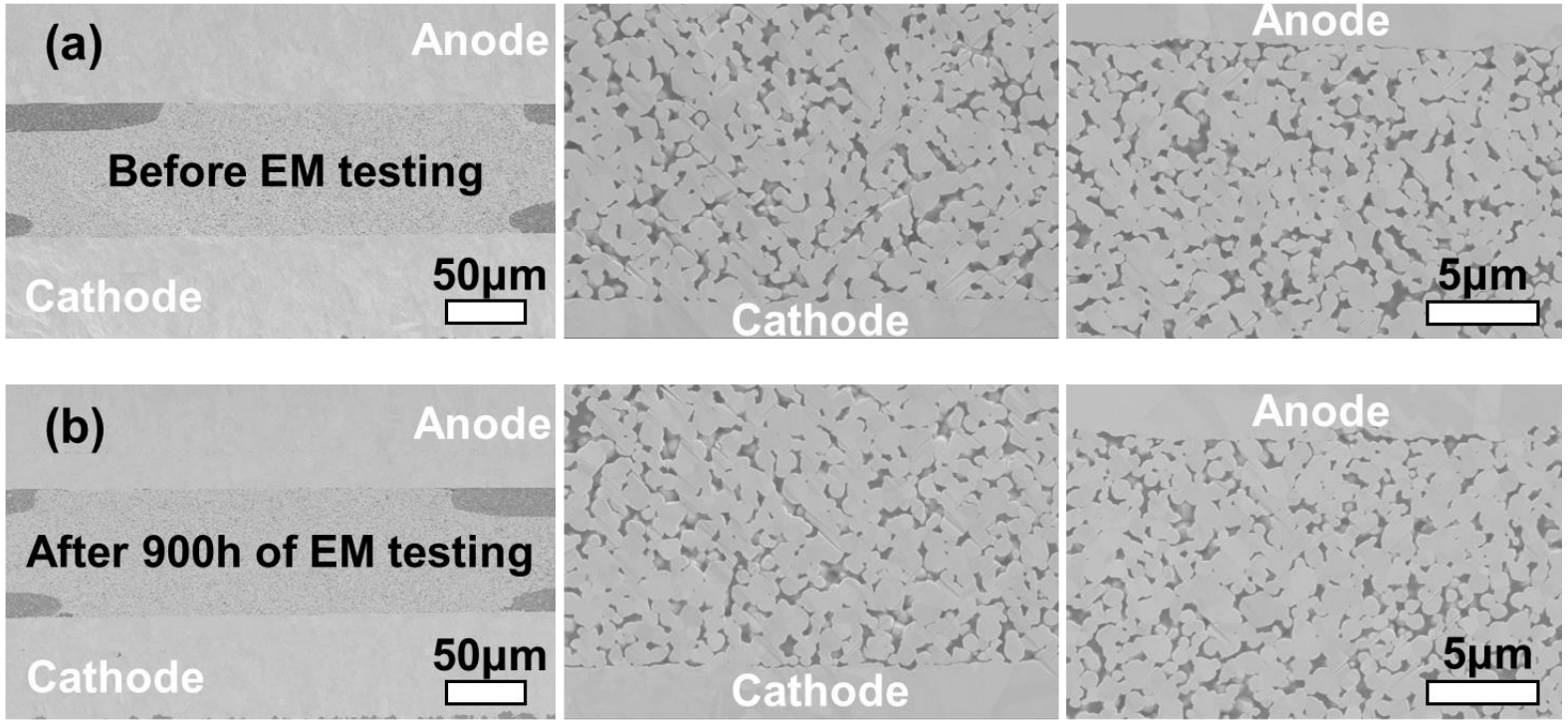




Open-circuit failure of SAC305 BGA interconnect: crack formation and growth at Cathode

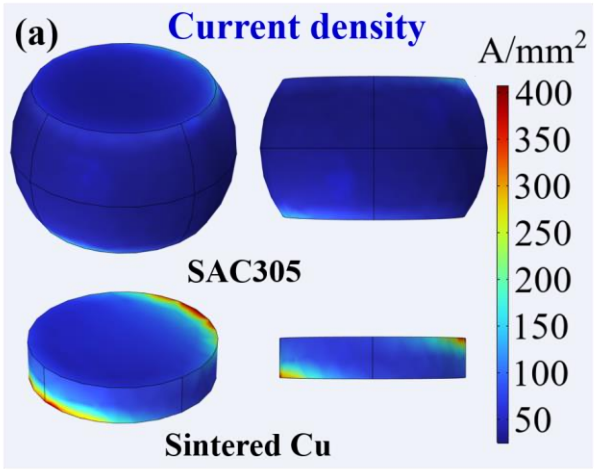
Proposed solution: Cu sintering

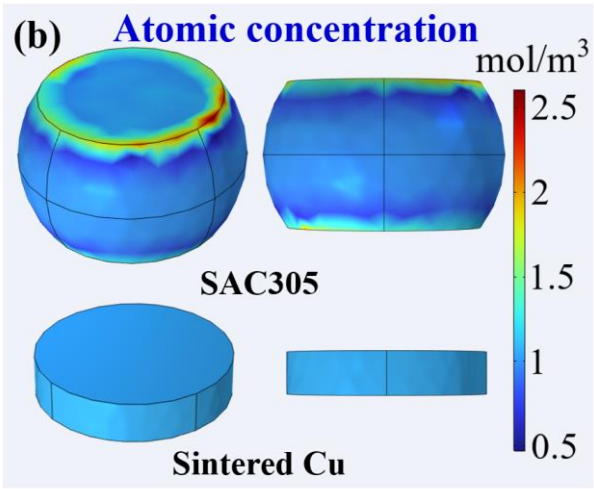


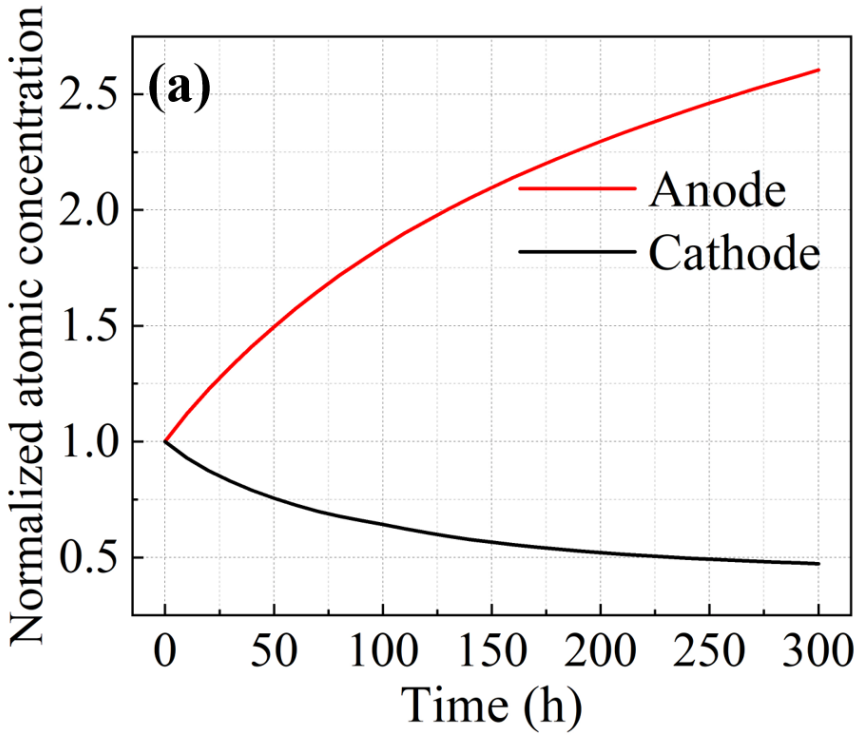


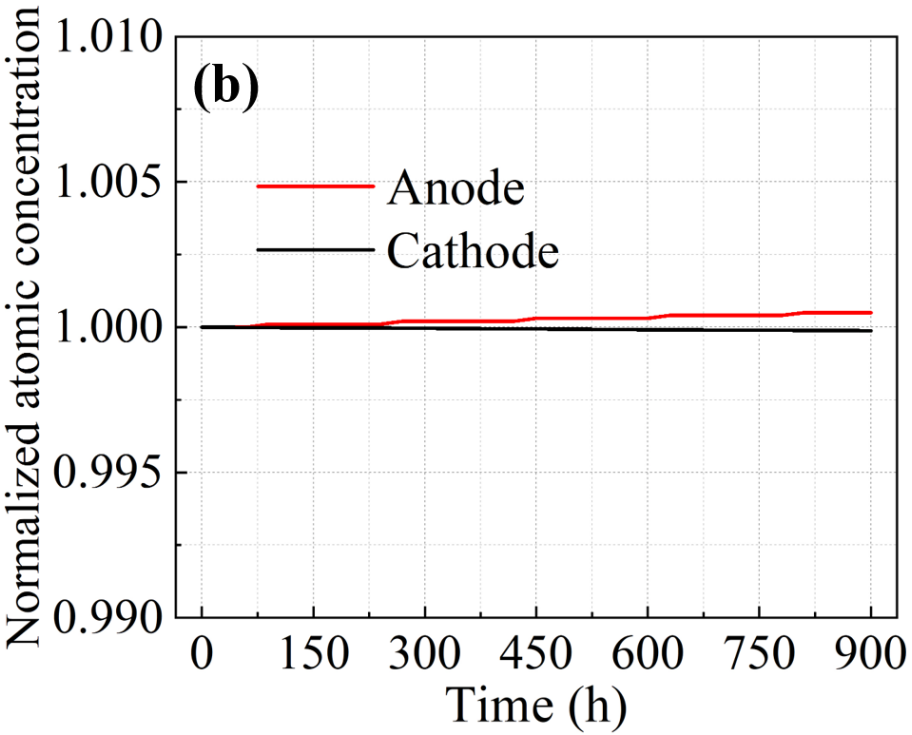
Microstructure of sintered Cu remain unchanged, showing that Cu atoms migration was negligible. This microstructural stability is consistent with the stable electrical conduction

Proposed solution : Cu sintering



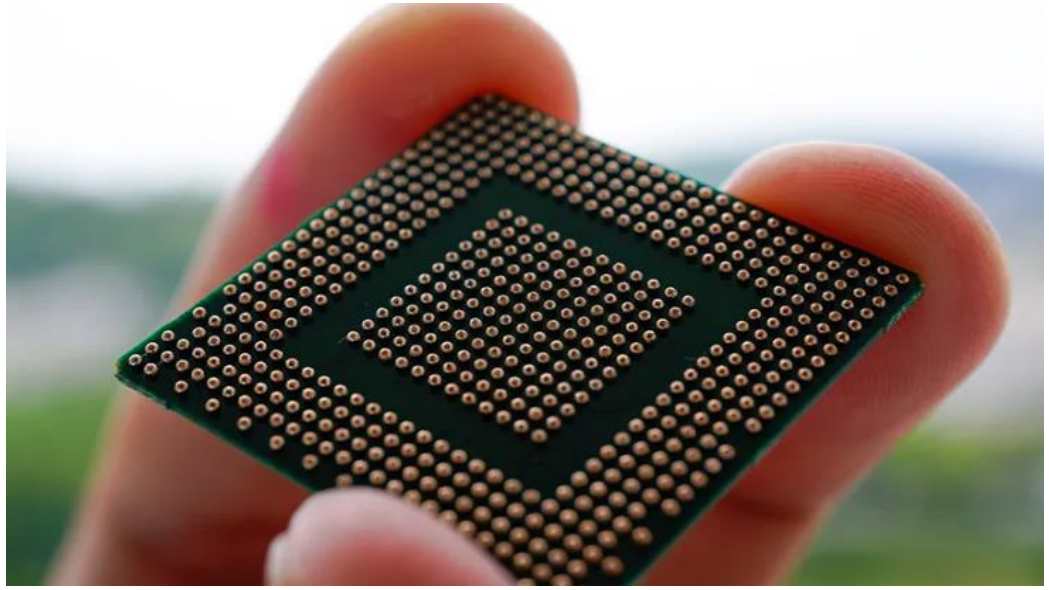


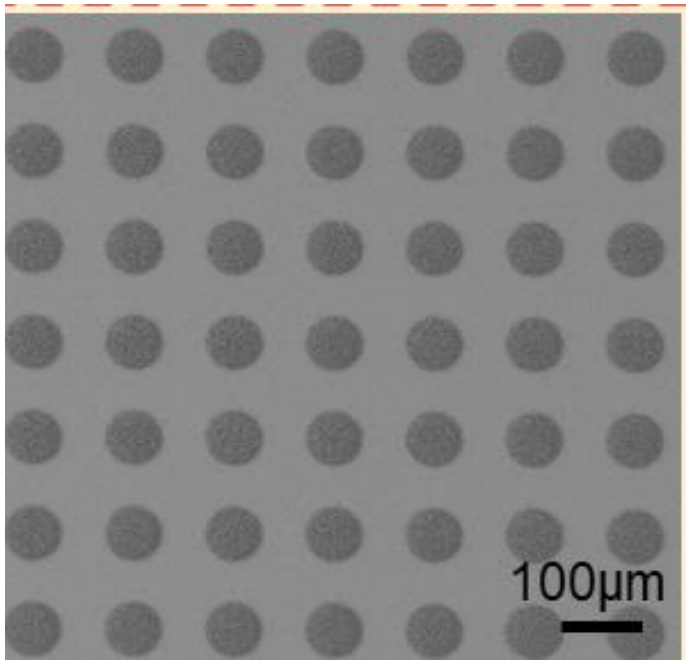




For SAC305 at 300 h of EM testing, significant atomic concentration occurs at anode interface. In contrast, atomic concentration of sintered Cu interconnect shows negligible variation at 900 h of EM testing.

Next steps





Large area with hundreds of Cu sintering BGA interconnects fabrication

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October 14, 2026
San Jose, California

