

PROGRESS TO SUCCESS

CDT 2.2: Interconnection materials

Partners: AALTO, ABB, BNT, BME, IFAG, NANOJ, SAL, TUDE, UNIBO

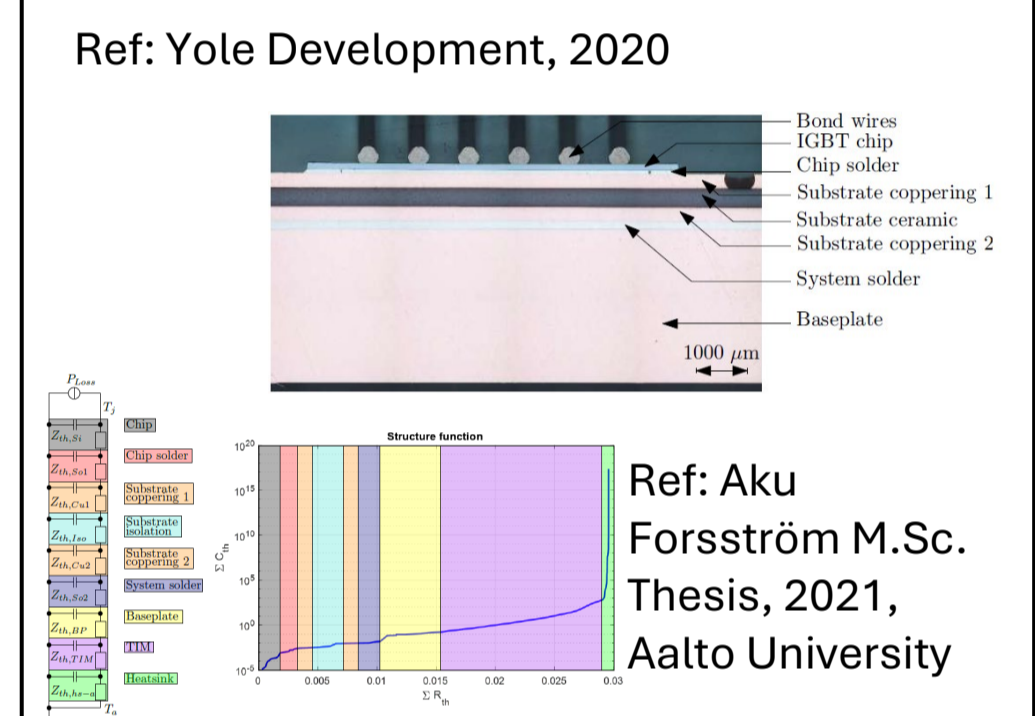
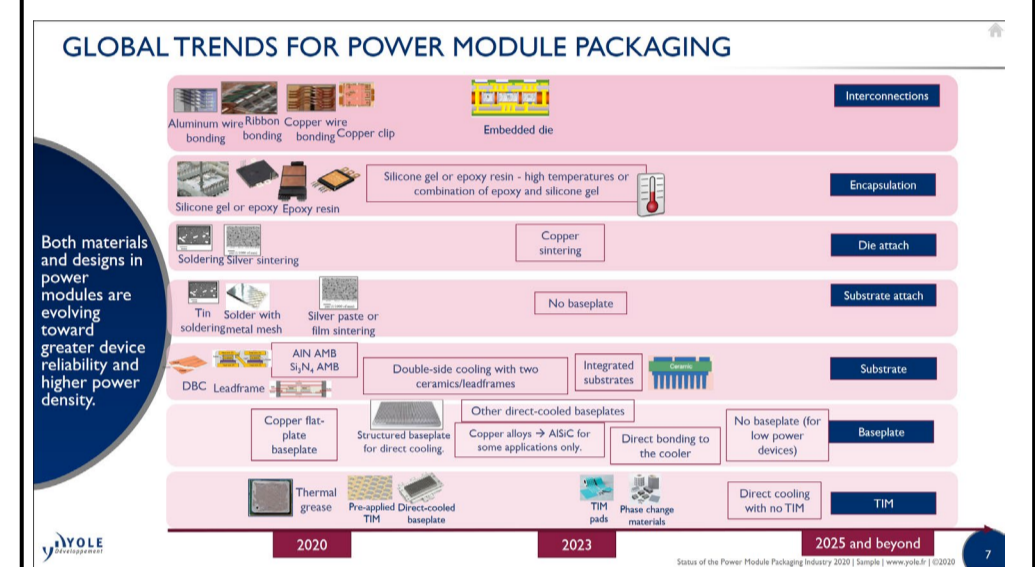
Objectives

- Novel Interconnection solutions
 - Front-side contacts replacing Al-wire bonding
 - Back-side contacts| Die attach for high operating temp. ($T_j \leq 200^\circ\text{C}$)
 - Substrate attach and TIM
- Sustainability via higher reliability, robustness and optimized manufacturing [DfR + DfM => DfE]

KPI

- Improved thermal performance to 50% increase the high temperature reliability
- Demonstration of direct T_j measurement to support health monitoring and detection of failure mechanisms (UC 3.1a)
- Selection of processes and materials that allow usage of higher performance materials (UC 1.5 & 3.1a)
- Material, manufacturing and reliability data for in-depth LCA studies (CDT 5.1)

Motivation & Relevance



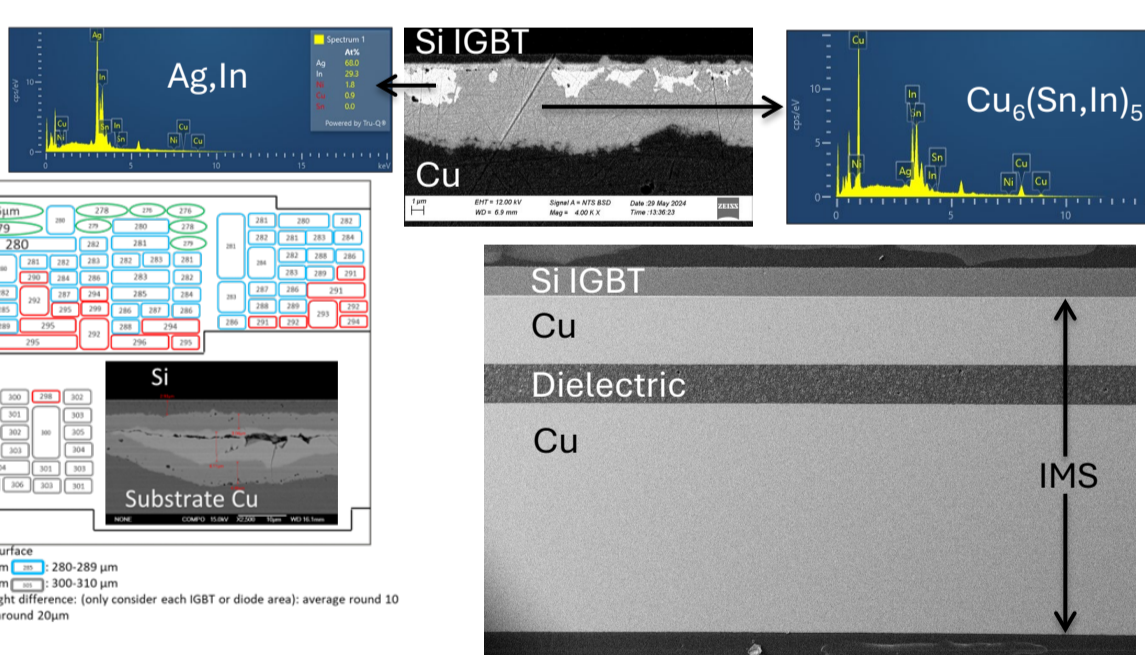
Results & Challenges

- Bonding quality, yield & reliability
- Traditional substrates vs. novel solutions

Interconnection solutions



DBC substrate

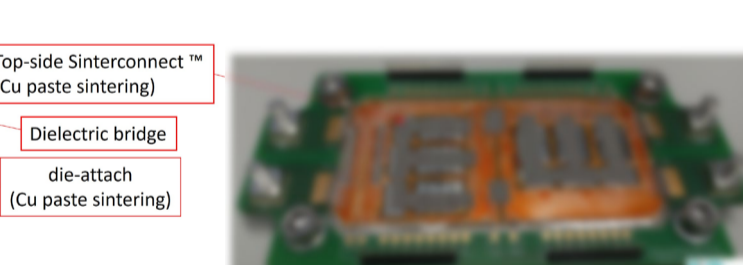
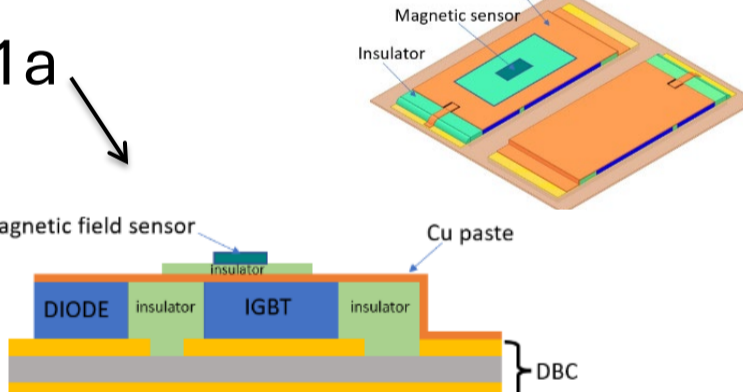
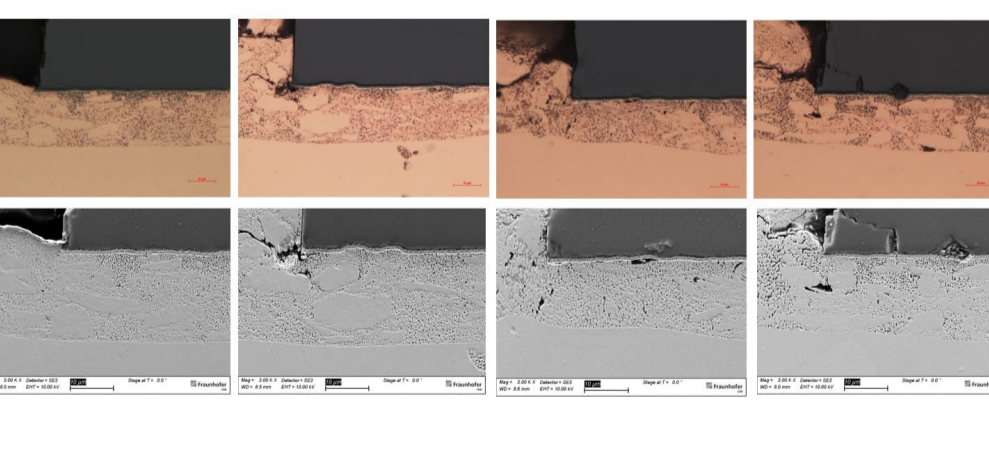
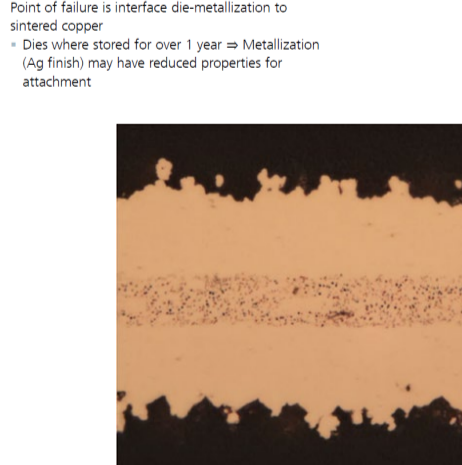


Shear test

Atmosphere	Sinter pressure (in MPa)	Not detached below (in MPa)	Detached at ... (in MPa)
Silicium	>15	9 of 12	34.9 - 42.2
Nitrogen	>15	9 of 14	28.1 - 41.1
Hydrogen	>11	2 of 6	11.0 - 41.7
Hydrogen	>6	0 of 2	31.0 - 32.0



Sinters DBC Cu-Finish, SiC 4.8x4.8, HSCuP-007, 50 um, Drying 90°C, 20min, Sinter T = 270°C, 10 min, Interface SiC/Cu-Paste/Substrate left, Die SiC Ti-Ni-Au-Ag, thickness 330/-35 um, Vacuum > 15 MPa, Nitrogen > 15 Mpa, Hydrogen > 6 MPa, Hydrogen > 11 MPa



ICP RIE-4H-SiC

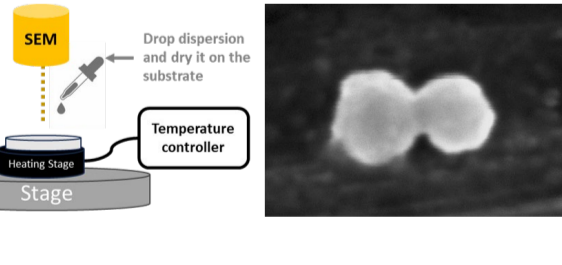
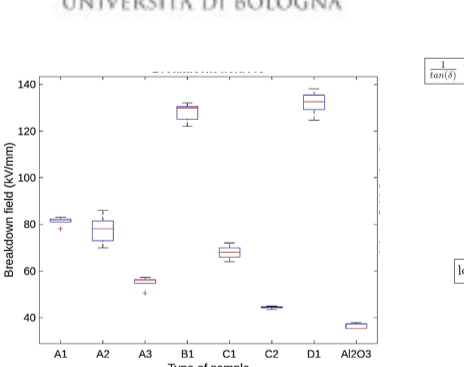
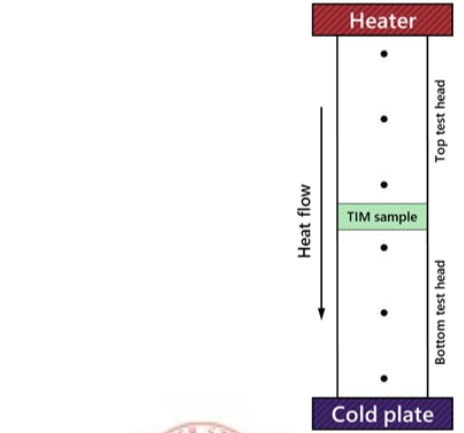
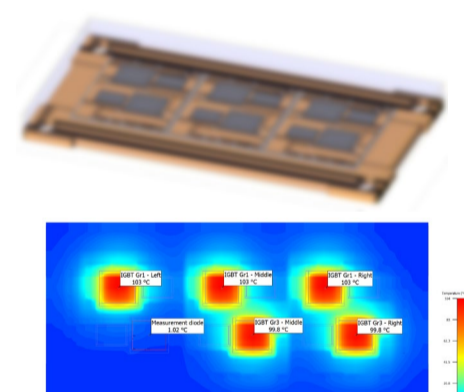


Fig. 5. SEM images of the cross-section of the etched structure after 10 min of etching in SF6/O2 plasma. The etch depth is around 10 um.

Characterization



The project has been accepted for funding within the Key Digital Technologies Joint Undertaking (KDT JU), a public-private partnership in collaboration with the HORIZON Framework Programme and the national Authorities of Germany, Belgium, Spain, Sweden, Netherlands, Austria, Italy, Greece, Latvia, Finland, Hungary, Romania and Switzerland, under grant agreement number 101096387. Co-funded by European Union.

