

Adhesive test program: summary

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Scope of the adhesive test program

- CGL7018 is current baseline:
 - 1 component thermal paste
 - its function is **exclusively “thermal”**
 - the mechanical link of the module on the support relies on **permanent UV tags**
 - the **long term reliability is unknown** (it is a grease, only **partially cured**)
- the aim of the adhesive program was to qualify other alternatives: real adhesives providing both a **mechanical and thermal coupling**

Module-support adhesive requirements

- Thermal conductivity: $> 0.2 \text{ W/mK}$
- Soft: shear modulus $< 50 \text{ N/mm}^2$
- Radiation hard
- Electrically non conductive
- Curing at room temperature
- Not flowing during application: adhesive confined within chip
- Good wetting properties
- not creeping after curing
- Allow module replacement without damaging the support

Status of the selection

- Extremely hard to find an adhesive fulfilling all the requirements
- We started with a list of 15 candidates
- after two selection steps we restricted the choice to the following two:
 - Eccobond 45 (Emerson Cuming): soft 2 component epoxy
 - SE 4445 (Dow Corning): 2 component silicon

Eccobond 45 vs SE4445

- Thermal conductivity: OK (similar to CGL7018)
- good wetting
- creep: OK
- thermal cycles: no effect observed
- flexibility OK for mechanical stability

- Pro's

- good applicability
- stable

- Con's

- difficult removal (need to heat up to 70 C, difficult to clean)
- stiffer (more stress on module)

- Pro's

- better thermal performances
- very flexible: easy removal, less stress on module

- Con's

- applicability is more complicated (need filler to avoid infiltration in between FE chips)
- degradation after irradiation ?

Application procedures

- Eccobond 45 as well as CGL7018 can be laid down using sticking masks, or alternatively by siring (the application is relatively easy)
- SE 4445 is more tricky to lay down preventing infiltration in between FE chips. A calibrated and automated dispensing is needed, Bonn have got good results with calibrated glass micro-spheres avoiding excessive squeezing (but need to assess impact of surface planarity)

Short term work plan

- Shear and creep tests on irradiated SE4445 (Marco and Polina)
- irradiate and repeat temperature cycles on samples already temperature cycled (Marco and Wolfgang)
- equip a full stove with dummy Si heaters glued with the three adhesive candidates and perform an evaporative cooling test to get a final assessment of the different thermal performances (Marseille)
- get more experience on SE4445 application.

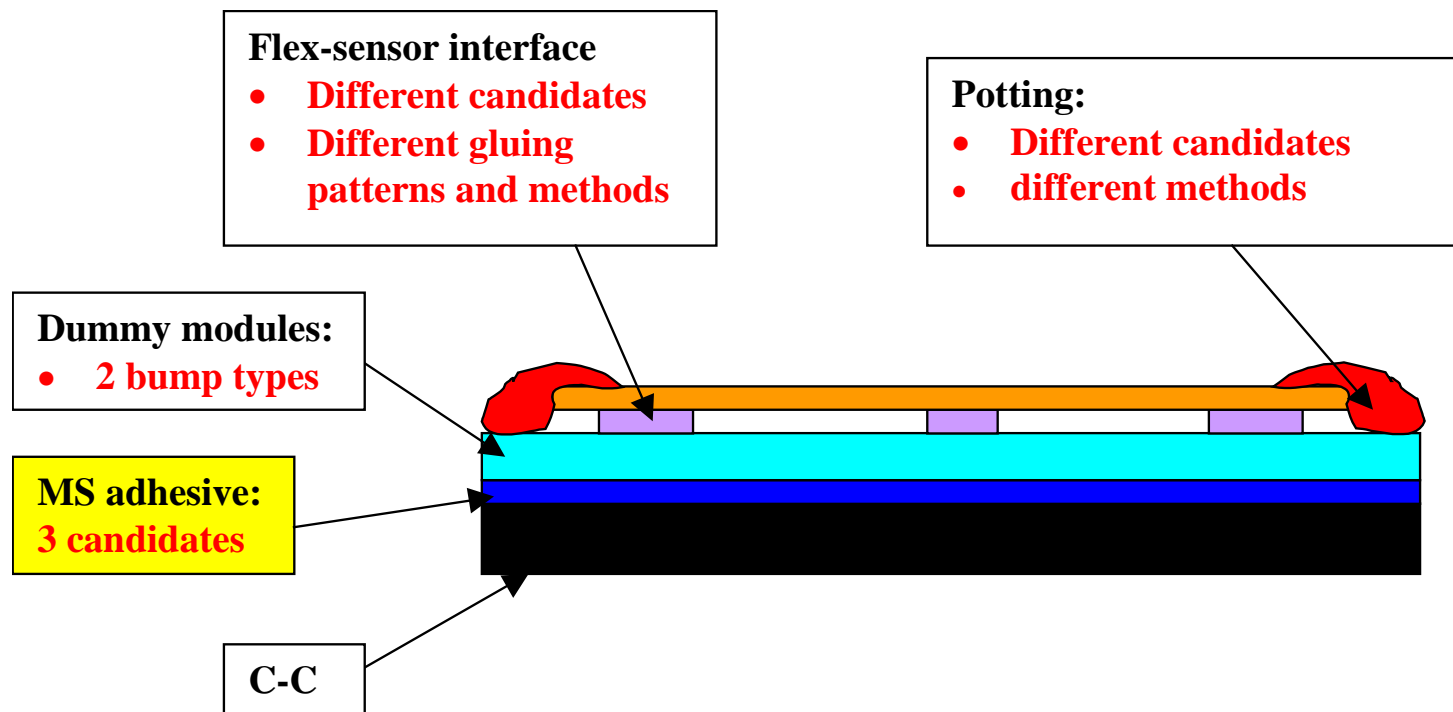
Preliminary conclusions

- On the basis of the results available up to now we have two alternative options to CGL7018, both with some disadvantages
- for the time being it is not possible to restrict the choice to only one alternative
- the adhesive working group has almost finished its task

Next steps

- In the initial test program we planned as next step to look into impact on bumps
- this involves dummy modules and other parameters of the module which are already under study by the module group
- the gluing activity should naturally merge into the module group

Module parameters to be assessed



How to move ahead

- Proposal to reorganize the activity inside the module group
- find a new coordinator, closer to the lab activities
- need contact person for each lab:
 - Bonn:
 - Genoa:
 - LBNL:
 - Marseille:
 - Wuppertal?
- Need to write down protocols for qualifications tests at module level