

Micro-Nano Breakthrough Conference 2005

Working Group on Electronics Packaging & Cooling

Start of the session was delayed by Skip Rung's request due to an earlier proceeding going over-time. Chris Leyerle, facilitator of the group convened the proceedings just after 10:00 on Wednesday, July 27, 2005.

Leyerle introduced himself and his company, Enerdyne Solutions, and outlined the proposed purpose and objectives of the group:

- * Colloquial exchange of ideas and perspectives
- * Identification of trends and directions
- * Discussion of barriers and obstacles; possible approaches
- * Networking and future collaboration

All in attendance then took turns introducing themselves and briefly outlining their institutional roles and interests.

Based on everyone's introductory remarks and with the assent of the group, the first discussion topic was on MEMS packaging:

- * How should the strain in processing be handled?
- * IC processes don't translate well to MEMS; much research still needed as processes are not standardized
- * Interconnects drive design of MEMS to a large degree, and design is constrained by this need to make the interconnect work
- * What are the environmental impacts on MEMS and MEMS design?
- * In general, all MEMS are custom and every package has to be done from scratch according to the particular environment and function (e.g. sensor or actuator)
- * There isn't much collaboration or sharing in approaches to MEMS packaging design; solutions are custom and there is little or no off-the-shelf solutions or technological know-how.
- * Standards don't exist and/or are not well-defined; participants were unsure how to change this or whether, due to the inherent level of customization, it could be much changed in the near term.

Leyerle proposed the next topic: does increasing miniaturization and power consumption reductions together make the problem of cooling devices easier or harder to do?

- * Consensus is that it is getting harder, notwithstanding power reductions
- * Surface area of the devices is the key driver—more surface area is needed for cooling, but this goes against desire for size reduction
- * Adding features and chip processing speed is causing more heat than is being removed by smarter power usage/less leakage

- * The current ASTM D5470 test standard for thermal interface materials is inadequate and not fully useful for apples-to-apples comparisons. The test results can be distorted by variations in clamping pressure and bond-line thickness
- * Cooling needs to be integrated at the die level; cooling by mating surfaces is increasingly inadequate due to the growing heat flux densities
- * 3D chip architectures are exacerbating the problem as surface areas are increasingly less free to have thermal solutions attached to them.

The participants' final topic was a discussion of current and possible collaborative efforts:

- * What university or college collaborations or organizations exist? Some felt that there was much more going on than anyone knew about; as a result there was a lot of redundant and wasted effort that could be reduced by more awareness and communication
- * Need a research project to determine who's doing what and where to facilitate better coordination of research
- * Who should do this? IEEE? IMAPS? Other?
- * Some participants disagreed that this was a problem rather than a healthy jostling of a vibrant industry—too much organizing and planning may have the effect of reducing innovation or those who take the risk of trying what the received wisdom says is impossible.
- * It was noted that companies such as Intel fund multiple internal groups to attack the same problem and free them to do it in different ways while deliberately not coordinating them
- * Additionally, research funding comes from companies and others who may be in competition with each other—will those doing the funding accede to collaboration that would vitiate the advantage they seek to derive by targeted funding? Would collaboration affect funding sources?
- * How would IP be handled in a different, more collaborative model of R&D?
- * Ron Howarth of GlimmerGlass agreed to use his contacts within Sematech to push them to generate an overview of current collaborations and areas of research. He further proposed a summit for people to make collaboration a reality.

The group adjourned about 11:15 and several participants exchanged business cards and continued discussions separately.

Respectfully submitted,

Chris Leyerle

Secretary pro tem