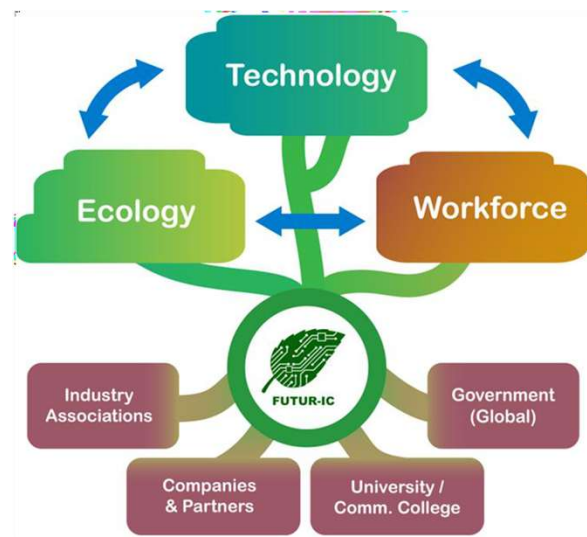


Adhesives Characterization for Optical Packaging (ACOP) Project

- Adhesive materials and assembly methods need to be evaluated and developed for more environmentally and economically sustainable high-volume manufacturing of optoelectronic systems
- There is an industry-wide lack of understanding of these materials, test methods and standards

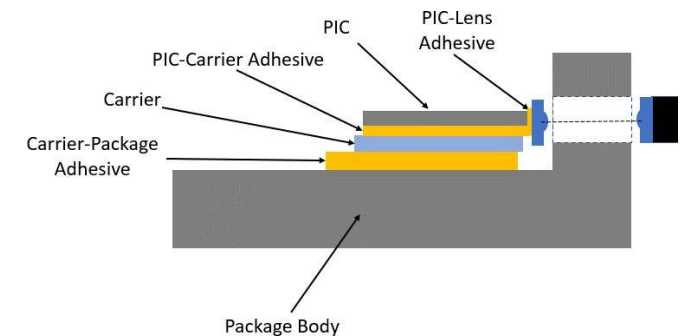


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iNEMI
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Adhesives Characterization for Optical Packaging (ACOP) Project

Motivation:

- Photonics and co-packaging applications are expanding and offering more sustainable solutions
- Adhesive materials and assembly methods need to be evaluated and developed for more environmentally and economically sustainable high-volume manufacturing of optoelectronic systems.
- There is an industry-wide lack of understanding of these materials, test methods and standards.



Project Scope

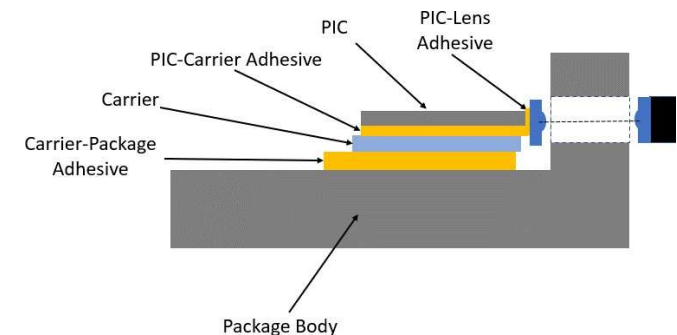
- Investigate current state of adhesive development
- Evaluate and characterize representative materials and test methodologies
- Develop guidelines for industry, and potentially standards bodies, on materials selection, design guidelines and a common set of tests methodologies
- Investigate challenges for transition to high volume manufacturing including assembly process development and digitalization, cost and sustainability benefits
- Develop training content for researchers and industry in sustainable optical system assembly

Adhesives Characterization for Optical Packaging (ACOP) Project

Fundamentally this project will enable industry use of lower temperature sustainable interconnect solutions in optical systems

Industry Impact of Expected Outcomes

- Grow the industry's materials knowledgebase, validating characterization and test methods for enabling faster sustainable optoelectronic solutions.
- Speed up the identification of key material properties and process concerns for assembly, performance and reliability of optical assemblies and systems by leveraging cross stakeholder consortium project including industry leaders in materials, equipment and system integration
- Develop Guidelines for optical packaging adhesives selection and testing to help drive alignment along the supply chain and move processes out of pilot in to Volume manufacturing
- Deliver recommendations for industry standards development will help ensure quality and reliability
- Recommend paths to high volume assembly will help direct investment in material and equipment at the high TRL levles
- Reduce time and thus saving money for industry to identify and qualify suitable adhesive materials
- Develop training content for researchers and industry in sustainable optical system assembly to enhance the needed skill sets



Adhesives Characterization for Optical Packaging (ACOP) Project

Status

- Verified through industry discussion and future trend/ roadmap reviews the need for work on optical adhesives to support development of new optical packaging solutions
- Leveraged findings from previous and on-going iNEMI work to refine and strengthen work program to enable faster approach e.g. selection of recommendations from Qualification methodologies for new packaging technologies project, understanding of challenges from the Board-Level Optical Interconnect in Immersion-Cooled Environments project
- Identified and investigating key characterization test methods presentably used for adhesives – typically optical properties not tested but will needed to be for future optical applications. Not test vehicles available industry wide.
- Developed optical adhesive survey for industry to understand future packaging requirements, test methodologies being presently used and assess sustainability knowledge, strategy and concerns
- Contacting adhesive, equipment and other industry and research stakeholders to get engagement for survey review and experimental work

Delays and Risks

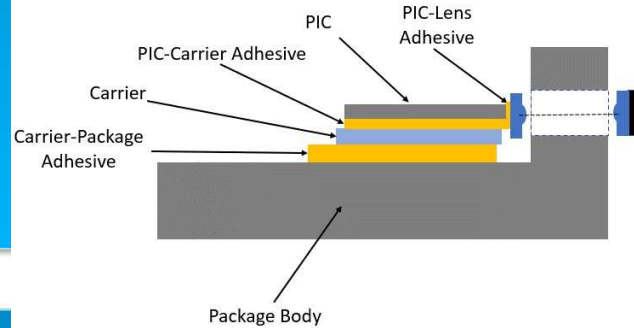
- Lack of high volume opportunities had slowed interest of the material and equipment suppliers in recent years, but in the latter half of this year there has been renewed interest with anticipated growth in AI and HPC and Data center applications which will leverage optical solutions
- Adhesive material development still at the IP stage for many companies, leading to an initial lack of material and delayed engagement for consortia approach. Materials now starting to become available from the large suppliers due to industry interest and industry starting to define their needs better.
- This project needs experience industry leadership to ensure the enabling impact; it took longer than anticipated to recruit good candidates to plan and manage. ~~This is now resolved.~~



Adhesives Characterization for Optical Packaging (ACOP)

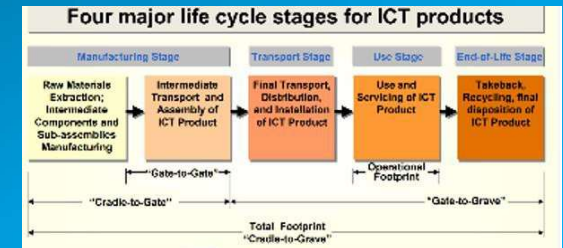
iNEMI Methodology for New Package Material Qualification

- Understand Use Conditions
- Identify Tools and Best Practices
- Conduct Test to Failure
- Develop Sequential Stress Testing
- Conduct Safe Launch
- Complete Failure Analysis
- [Project Page](#)



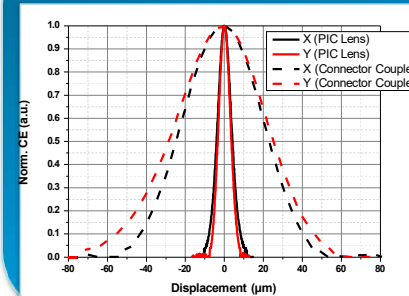
iNEMI Eco-Impact Estimator (EIE)

- Understand the environmental impacts of materials and processes being selected so as to optimize sustainable solutions



Board-Level Optical Interconnect in Immersion-Cooled Environments project

- Experimental test matrix for optical components and materials as insufficient understanding of how will perform in immersion-cooled environments
- Testing will be conducted on non PFAS coolants
- [Project Page](#)



Module with Separable Single-Mode Expanded-Beam Optical Interface for Edge-Coupled PIC Optics

- Developed understanding of the assembly and testing challenges
- Noted need to support development of adhesives and test methods to enable high volume deployment
- [Project page](#)