Exposure setup to test the influence of different wavelengths on the degradation of adhesive bonds

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As adhesives find their application in many lithography and metrology system components of ASML Holding N.V., it is crucial to make sure that the adhesives are long-lasting and support the intended functionality of the systems in which they are implemented. Adhesive bonds undergo exposure to different wavelengths in varying intensities and multiple ranges of environments including, but not limited to pressures, temperatures, and gas compositions in these systems. It is difficult to find specific information about how these conditions affect the degradation of adhesive bonds. This raises the need of a light exposure setup, which can deliver accelerated light exposures of various wavelengths and environmental conditions to investigate the effects of these variables on the degradation of adhesive bonds. Such a test setup is not available with Adhesive Competence at ASML Holding N.V. currently.

The system engineering approach was followed, and a combination of V-model and concurrent engineering methodologies was adopted for this project to have an optimal design outcome. From customer wish and multiple stakeholder interviews, the requirements for the light exposure setup were elicited as an iterative process. After prioritizing the use cases and analyzing feasibility, an architecture description of the system was derived. This conceptual model helped in identifying the functional sub-systems for the light exposure setup, which are light generation, light shaping and transport, exposure chamber, data acquisition and control, user interface, and thermal management, primarily. All the sub-systems and their designs are guided by the requirements for safety. The prioritized use cases, feasibility, safety, and constraints like the lead time in delivery of parts determined the design scope of these sub-systems.

Detailed design followed conceptual design of the sub-systems - light generation, light shaping and transport, exposure chamber, user interface and safety. Selection of the light sources for the setup, design of the beam path, design of the exposure chamber that is vacuum compatible, design of the user interface, design for green label (internal safety certification for lab equipment), etc. were results of the design steps. Many of the ordered parts and components for hardware realization have already been delivered.

The tasks completed in the first year of the overall timeline in order to realize the light exposure setup are covered in this thesis report. This also includes the results and observations from the proof-of-concept demonstration of the beam path design. This is an ongoing project at ASML Holding N.V., where the complete integration of the setup is expected to be completed by 2024.