Integrated Circuits (ICs) are essential in our daily lives, as they can be found in all technical devices. The majority of these chips have been produced by lithography machines manufactured at ASML. The size of a chip keeps decreasing, roughly following Moore’s law since the 1960s. In order to keep this trend going, ASML will switch from a deep ultraviolet light (DUV) to an extreme ultraviolet light (EUV) light source. This reduction in wavelength from 193 to 13 nm will come with significant tighter specifications for all parts within the scanner. Including the pellicle, which is a thin film in front of the reticle, but outside its focus plane. This pellicle captures any dust particle and contamination to uphold a clean reticle for imaging. When the scanning slit illuminates the wafer, all non-transmitted light by the pellicle is absorbed and converted into heat. In order to optimize the pellicle, its materials need to be well understood at these temperatures. However, these parameters do not exist in the current literature.

During this graduation project, carried out at ASML holdings N.V. in Veldhoven, a new bulge test setup is designed and built that is capable of measuring the material parameters in a vacuum at these elevated temperatures. A bulge test creates a pressure difference over the free standing thin film, while measuring its deflection. This allows for the extraction of the Young’s modulus, pre-tension, ultimate tensile strength, coefficient of thermal expansion and other material properties.