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Adhesive bonding: applications and perspectives in UHV

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In the field of vacuum physics in industry as well as at research institutes the number of applications using optical signals for simple observation tasks, sample illumination or process monitoring increased dramatically in the last decades. As a result of the enhanced interest the demands on optical properties, the vacuum seals and the material properties of the vacuum optic components increase as well. As a consequence the joining technology between the optical material and the metallic surrounding becomes more important. In relation to the joining technology, the material choice and parameters of material processing have to be suitable for UHV applications concerning the cleanliness, outgassing and bakeout specifications and have to maintain the required high optical quality.

The present contribution focusses on the rapidly developing technology of adhesive bonding. Therefore, the benefits of adhesive bonding compared to the well-established techniques like brazing and thermal fusion are discussed using two examples: vacuum viewports and optical fiber feedthroughs. In terms of brazing or thermal fusion the choice of the optical material and the metallic surrounding is strictly limited, whereas adhesive bonding allows a flexible choice depending on the purpose of the application. In addition, in case of adhesive bonding the talk addresses the well-established concern of UHV compatibility and proves with experimental investigations the UHV suitability. In the contribution, the different joining technologies are characterized concerning technical and commercial aspects. Simulations and experimental data will be presented regarding mechanical stress, thermal cycling and outgassing rates.

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