LASER MICRO-WELDING OF OPTICAL MATERIALS

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Micro manufacturing is often limited by the capacity to effectively join components together in a reliable fashion. Conventional methods based on interlayers (glue, solder, frit etc.) often involve uncertainty in the final joined position or strength, or age badly due to creep and/or out-gassing. There is therefore a clear requirement for a joining technique without the need for interlayers. One advantage of using an ultrafast laser pulse lies in the ability to precisely control the location of the absorption region within transparent materials. When such a pulse is focused inside a transparent material non-linear absorption will occur at the focus. This creates a small heat affected zone (typically on the order of 10-100µm) which can be highly localized to the material join. By melting, or micro plasma generation, the material can be joined together and any gaps filled. When welding an opaque material to a transparent material the absorption is instead linear, and occurs at the material interface. While this increases the heat affected zone slightly it also reduces the required precision in placing the interface at the focal plane. In this paper we present recent results on welding of glass to glass, and also glass to metals, including an investigation of the fit-up requirements that must be satisfied.

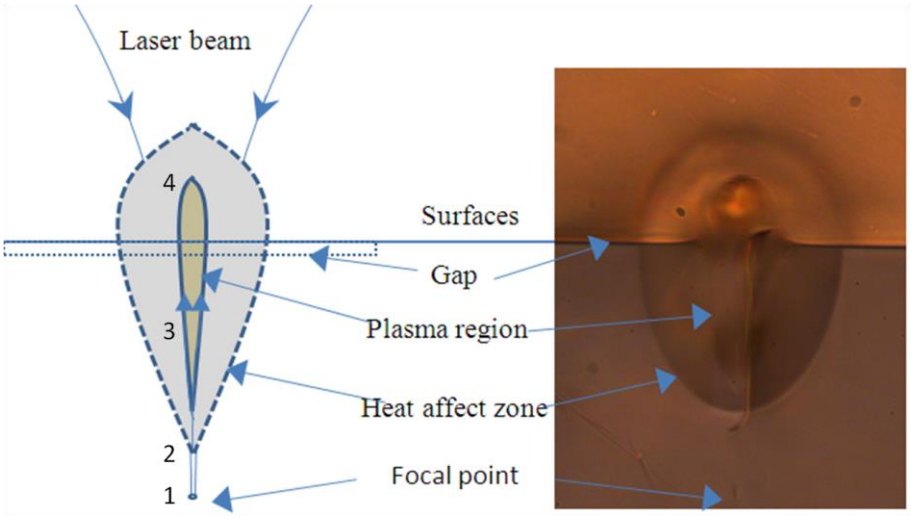

Fig. 1: Diagram of welding seam of two surfaces (the picture shows borosilicate glass with N-BK7, 1.51 W, 2 mm s^{-1}).