Assembly of a Novel CO2 Based Heat Zone Design to Optimize Absorption during Optic Fiber Processing

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Optic fiber networks stand as the most effective means of data and high power transfer infrastructure and have applications in military laser systems, laser surgery, broadband networks, etc as they provide an unsurpassed data transmission bandwidth with relatively small latency. The greatest challenges with the technology during optic processing is forming a strong fiber and reducing power loss. These arise in the fusion splicing process, in which separate fibers are melded together in an ideally even heat zone to produce a continuous path for transmission. The current splicing heat sources also pose an unresolved contamination issue, in which they deposit residue on the fibers during usage; the intrinsic contamination in deployed optics form localized hot zones during high-power transmission, which leads to bursting. In this work, an inexpensive, easily-implementable method of providing a consistent and contamination-free heat zone with a CO_2 laser heat source was proposed, designed and tested. Implementing dual-axicon reflective elements, the design converts the linear laser beam into an annular light structure that bands around the fiber's perimeter. By attaching a telescope assembly, another novel characteristic of the design is its ability to deliver varying power density levels and adjustable heat zone sizes. After correcting for laser instability, the optimized machine was capable of forming clean splices with power losses significantly lower and tension capacities over three-fold of the industry standard requirements across single and multimode fibers. The machine was also capable of splicing dissimilar fibers as well as fabricating fused fiber combiners and end caps via the thermally expanded core (TEC) and physical tapering processes.

Awards Won:

Second Award of $2,000

National Aeronautics and Space Administration: Honorable Mention