Light coupling into a Double-Clad Fiber

Graduate

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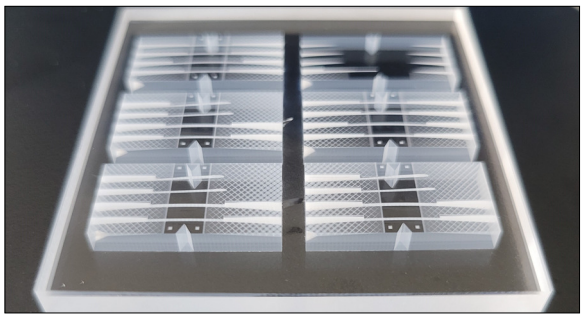
Objective: To improve the measurement accuracy of laser scanners, internal error sources must be detected and compensated. In this project, this is done optically with the help of visible light, which is coupled into the system via a double-clad fiber. A double-clad fiber is used to guide the actual infrared measurement beam in the core of the fiber and to transport the visible light coaxially in the inner cladding.
To realize the light coupling, three concepts were elaborated, which worked with free space coupling or lateral coupling of the visible light via side polished fibers. To avoid speckles, laser light sources were omitted and the demonstrators were tested with LEDs and superluminescent diodes. The intention was to achieve a homogenous illumination of the multimode area of the double-clad fiber.

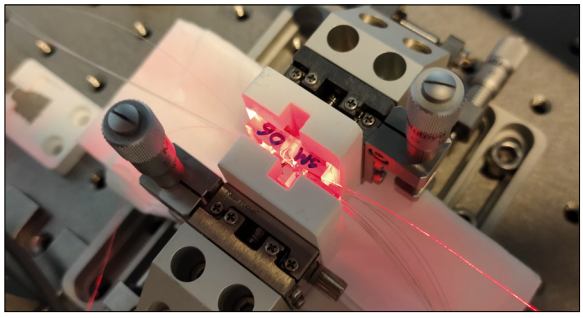
Approach / Technology: Three concept ideas were simulated in OpticStudio to obtain information about the setup and the coupling efficiency. Subsequently, the required components could be ordered or manufactured in-house. For the concepts with lateral coupling, fibers were glued into a glass block, which was manufactured using the SLE process. Subsequently, the block was grinded and polished resulting in side polished fibers. The light-carrying structures were brought very close to each other in order to achieve light coupling.
The best demonstrators were finally glued permanently and the coupling efficiencies as well as the homogeneity of the illumination were characterized.

Result: The coupling efficiencies achieved for the visible light varied significantly. The highest coupling efficiency was achieved with lateral coupling, where about 95% of the visible light was coupled into the double-clad fiber and the infrared source was spliced directly.
The homogeneity measurements showed slight intensity variations in the far field. Light speckles of the superluminescent diode could be observed in the center of the light spot.

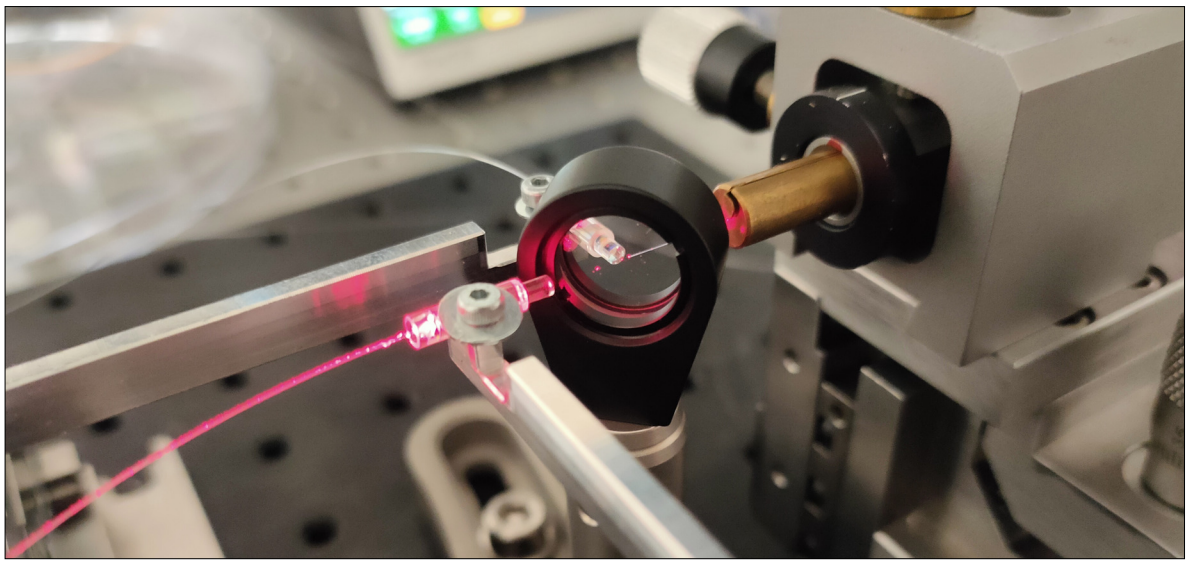
Glass substrate after laser writing
Own presentment



Assembly for side coupling into the Double-Clad fiber
Own presentment



Assembly of the free-space solution: coupling of both wavelengths into the double-clad fiber using a dichroic mirror
Own presentment



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Subject Area
Photonics

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