Abstract: A new scheme of double-variable-curvature (DVCM) employing a single-step grinding technique with fully automatic process for efficient and high-average coupling from highpower 980-nm lasers into single mode fibers is reported. The DVCM exhibited a double-variable curvature in the major and minor axes. The perfect DVCM precisely controls both grinding offset less than 0.5 mm and minor radius curvature of 2.4 – 3.5 mm that leads to high-average coupling efficiency of 84.5%. This demonstrates that the high-average coupling efficiency through single-step grinding with fully automatic fabrication of the DVCM is better than any other grinding techniques to form asymmetric microlenses. From art (or engineering) point of view, we are able to fabricate any kinds of perfect fiber microlenses. Mode (spot size and phasefront) mismatch between the laser diodes and single-mode fibers (SMFs) can lead to a significant insertion loss. However, limited information is available for the quantitative understanding of the phasefront match between laser diodes and fibers. Here, a direct near-field phase and intensity measurement in diode lasers, SMFs, and DVCMs is demonstrated by employing a SMF interferometer. From science point of view, detailed understanding of the near-field phase and intensity distributions of light sources and optical components are essential for designs of microoptics with better mode matching to minimize the insertion loss.

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