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The Art and Science of Packaging High-Coupling Photonics Devices and Modules

Wood-Hi Cheng

Department of Photonics, National Sun Yat-sen University, Kaohsiung, 804 Taiwan

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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 doublevariable curvature in the major and minor axes. The perfect DVCM precisely controls both grinding offset less then 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 tha thigh-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.

Short CV: Wood-Hi Cheng is a Chair Professor at National Sun Yat-sen University, Kaoshiung, Taiwan, where he founded and became the Director of the Institute of Electro-Optical Engineering (1994-2000), and Dean of College Engineering (2002-2005). In 2007 he chaired the Southern Taiwan Opto-Electronics Center of Excellence. Prof. Cheng's most significant R&D is the demonstration of record ultra-broadband 300-nm Cr-doped fibers (CDFs). The CDFs have been used for the first time as a broadband Cr-doped fiber amplifier (CDFA). Prof. Cheng is a Fellow of IEEE and OSA. He served as a Chair for the IEEE Photonics Society, Taipei Chapter, during 1999–2000, and served as a Chair for the OSA, Taipei Chapter during 2005–2006. He was recipient of the IEEE Photonics Engineering Achievement Award in 2010 for his contributions to design, development and commercialization compact solid-state laser modules, and the 2011 IEEE Photonics