A NEW METHOD FOR LOAD MATCHING IN MULTIMODE-MICROWAVE HEATING APPLICATORS BASED ON THE USE OF DIELECTRIC-LAYER SUPERPOSITION

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ABSTRACT: *Usage of a dielectric multilayer around a dielectric sample is studied as a means for improving the efficiency in multimode microwave-heating cavities. The results show that by using additional dielectric constant layers the appearance of undesired reflections at the sample-air interface is avoided and higher power-absorption rates within the sample and high-efficiency designs are obtained.* Microwave Opt Technol Lett 40: 318–322, 2004; Published online in Wiley InterScience (www.interscience.wiley.com). DOI 10.1002/mop.11367

Key words: *microwave energy; microwave heating; dielectric properties; multimode applicator; power efficiency*

1. INTRODUCTION

Industrial microwave heating applicators need to be as efficient as possible in order to conform to ever-demanding economic requirements. This point is especially critical due to the fact that traditional industrial heating technologies employ energy sources at much lower cost than that of electricity. Consequently, microwave energy generated at the magnetron has to be transferred to the load in order to avoid energy losses or interfering reflections [1]. On the other hand, the reduction of power reflection back to the power source ensures better work conditions and longer duration for the magnetrons.

In spite of the widespread use of planar circuits in communication circuits, the high power level required for industrial microwave-heating applications forces the use of waveguides in order to feed the applicator and, hence, matching stages cannot follow the conventional matching approach based on lumped or distributed elements [2]. Thus, in this kind of applicator, several strategies have been traditionally followed to achieve good load matching to the source, including tunable short-circuits, and double, triple or quadruple stubs [3, 4]. However, these kinds of devices are based on circuits and not an electromagnetic foundation.

In this work, a new approach for achieving high power efficiency in multimode-microwave heating applicators is proposed. This new technique consists of adding intermediate dielectric

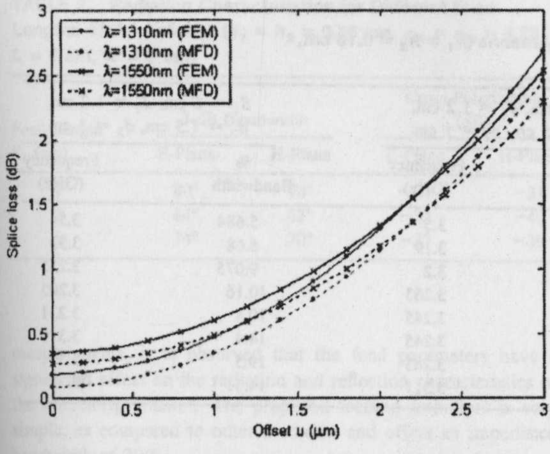

Figure 4 LMA10 PCF (d/Λ = 0.458, Λ = 6 μm)/SMF-28 splice loss as function of offset u for wavelengths of 1310 and 1550 nm. FEM: results obtained from the overlap integral technique using the field distribution obtained from the full-vector FEM; MFD: results obtained by using Eq. (1) [or Eq. (2)] and Eq. (3). [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

which agree well with the estimated values of 0.27 and 3.2 dB, respectively.

3. CONCLUSION

In conclusion, a simple but general formula for estimating the mode-field diameter (MFD) of the LMA PCF has been obtained. The formula can be used to estimate the splice loss between LMA PCF and SM fibers once the basic fiber parameters (d/Λ, Λ for PCF, and V-number of SM) are obtained. The accuracy of the loss estimation was compared with the more accurate-overlap integral technique by using the field distribution obtained via the full-vector FEM and was found to be below 0.2 dB.

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