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Low Loss Splicing Methods of Photonic Crystal Fibre and Single Mode Fibre

Introduction
Photonic Crystal Fibres (PCFs) are increasingly being used in applications like fibre lasers and optic fibre communication systems. The main problem with using PCF is due to the high loss associated when spliced with conventional single mode fibres. This project explores the possible methods of splicing PCF to SMF using standard laboratory equipment.

Objectives
- To reduce the losses of the PCF-SMF splice that is inherently large due to differing core diameters
- Obtain methods that enable convenient interfacing of PCF to SMF using common optical laboratory equipment

Method 1: Offsetting splice point
1. Offsetting splicing electrode to SMF side
2. Splice fibres to anneal
3. Repeated addition of arcs to collapse SMF core

Electrode offset to SMF side

By applying heat to the SMF side during the splicing process, the ‘swelling’ of the air holes in the PCF is avoided and at the same time, collapsing the thicker SMF core to fit the thin PCF core.

This resulted in a slight decrease in power loss with compared to conventional splicing technique in which the splice point is centrally aligned to the electrode.

Method 2: Fibre Lens Method

Making use of optic lenses properties, the collimated beam from the SMF can be focused onto the smaller PCF core by refraction of light. To shape the exposed end of SMF to be like a convex lens, SMF end is subjected to heat in the fusion splicer, causing the tip to ‘burn off’ forming a spherical structure.

1. Round off SMF edge using splicer
2. Align fibres using ferrule
3. Adjust air-gap separation
4. Secure fibres to ferrule

Benefits
Convenient methods that can be performed easily using standard optical lab equipment without introducing significant losses at the splice point.