

CLAIMS

1. A method of forming a splice to join two optical fibres, the method comprising:
5 providing two optical fibres, at least one of which is a hollow core optical fibre;
aligning an end of one of the optical fibres with an end of the other optical fibre
such that longitudinal axes of the two optical fibres are substantially along a same line
and the ends of the optical fibres are spaced apart;
performing a prefusion stage comprising:
10 applying an electric arc proximate the ends of the optical fibres in order to
soften the material of the ends;
moving the ends of the optical fibres together to make contact and then
exceed the contact by an overlap distance to form a fused portion in which the
ends are fused together; and
15 performing at least one pushing stage, each pushing stage comprising:
implementing a cooling period during which no electrical arc is applied;
at the end of the cooling period, applying an electrical arc to the fused
portion to soften the material of the fused ends; and
pushing the fused ends of the optical fibres further together.
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2. A method according to claim 1, in which the at least one pushing stage
comprises up to ten pushing stages.
3. A method according to claim 2, in which the at least one pushing stage
25 comprises three, four or five pushing stages.
4. A method according to any preceding claim, in which the at least one pushing
stage comprises pushing the fused ends of the optical fibres further together while the
electric arc is being applied.
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5. A method according to claim 4, in which the pushing is performed during a final
part of an arc time for which the electric arc is applied in the at least one pushing stage.
6. A method according to claim 5, in which the arc time is 200 ms or longer, and the
35 pushing is performed during a final part of the arc time in the range of 150 ms to 250 ms.

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7. A method according to any preceding claim, in which, in the at least one pushing stage, the fused ends of the optical fibres are pushed further together by a distance which is between 20% and 30% of the overlap distance in the prefusion stage.
- 5 8. A method according to any preceding claim, in which, in the aligning, the ends of the optical fibres are spaced apart by a gap in the range of about 2 μm to 10 μm prior to performing the prefusion stage.
9. A method according to any preceding claim, in which during the prefusion stage,
10 the overlap distance is in the range of 6 μm to 8 μm .
10. A method according to any preceding claim, in which, during the prefusion stage, the electric arc is generated using an electrical current in the range of 11 mA to 14 mA.
- 15 11. A method according to any preceding claim, the method further comprising:
performing a cleaning stage prior to the aligning, the cleaning stage comprising:
positioning the optical fibres with the ends of the optical fibres spaced apart; and
applying an electric arc proximate the ends of the optical fibres in order to
generate a plasma in a space between the fibre ends which removes contaminants from
20 end surfaces of the optical fibres; in which
the electric arc is applied for a cleaning arc time in the range of 20 ms to 30 ms.
12. A method according to claim 11, in which the electric arc is generated using an
electrical current in the range of 8 mA to 14 mA,
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13. A method according to any preceding claim, in which the hollow core optical fibre comprises a hollow core surrounded by a microstructured cladding in which the fraction of air filling is at least 0.9.
- 30 14. A method according to any one of claims 1 to 13, in which the hollow core optical fibre comprises an antiresonant hollow core fibre.
15. A method according any one of claims 1 to 13, in which the hollow core optical fibre comprises a photonic bandgap hollow core fibre.
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16. A method according to any one of claims 1 to 15, in which both of the two optical fibres is a hollow core fibre.
17. A method according to any one of claims 1 to 15, in which one of the optical
5 fibres is a all-solid optical fibre.
18. An electric arc fusion splicing apparatus configured to receive ends of two optical fibres and join the two optical fibres by forming a splice using a method according to any one of claims 1 to 17.
- 10 19. Computer-implementable instructions stored on a storage medium, the instructions for control of an electric arc fusion splicing apparatus, which when implemented by a computer processor enable an electric arc fusion splicing apparatus to join two optical fibres by forming a splice using a method according to any one of claims
15 1 to 17.
20. A splice joining two optical fibres, at least one of which is a hollow core optical fibre, formed using a method according to any one of claims 1 to 17.
- 20 21. A splice joining two optical fibres, at least one of which is a hollow core optical fibre, the splice having an optical transmission loss less than 0.5 dB and a splice strength greater than 3 N.
22. A method of forming a splice to join two optical fibres, the method comprising:
25 providing two optical fibres, at least one of which is a hollow core optical fibre;
aligning an end of one of the optical fibres with an end of the other optical fibre such that longitudinal axes of the two optical fibres are substantially along a same line and the ends of the optical fibres are spaced apart;
performing a prefusion stage comprising:
30 applying one or more beams of laser light proximate the ends of the optical fibres in order to soften the material of the ends;
moving the ends of the optical fibres together to make contact and then exceed the contact by an overlap distance to form a fused portion in which the ends are fused together; and
35 performing at least one pushing stage, each pushing stage comprising:

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implementing a cooling period during which no beam of laser light is applied;

at the end of the cooling period, applying one or more beams of laser light to the fused portion to soften the material of the fused ends; and

5 pushing the fused ends of the optical fibres further together.