

LT-0600

Fibre Optics Workshop

Basic



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1.0 Introduction

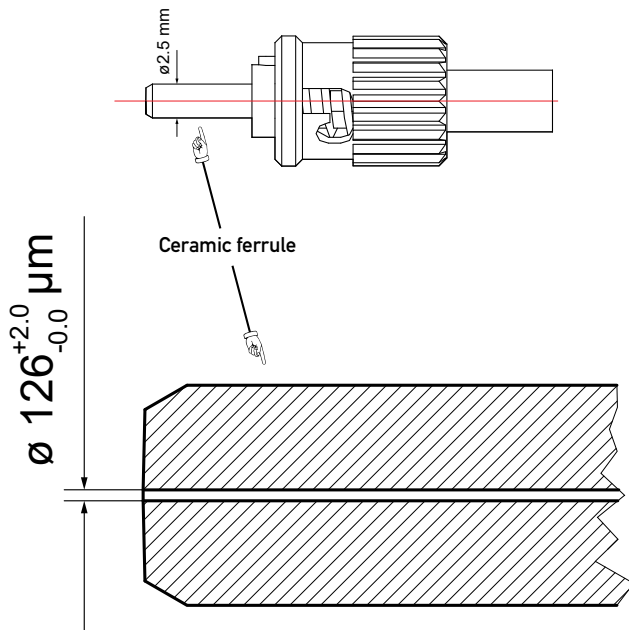


Fig. 1: Dimension of the fibre ferrule

In all communication networks the information carrying media needs connections. The most important communication networks are using optical fibres to transport modulated light. This concept requires optical fibre with a core diameter of $9 \mu\text{m}$ for single mode fibre and $50 \mu\text{m}$ for multimode fibre. Both kinds of fibre have in common the outer diameter of $125 \mu\text{m}$.

The goal of this workshop is to train the termination of an optical fibre with a connector. We will use multimode ST connectors. There exist a variety of other connectors, however the principle task remains the same.

To recall the dimension of the optical fibre, in Fig. 1 the dimensions of the connector are shown. The actual holder of the fibre is the so called ferrule which is made from ceramics with an incredible precision. The "hole" into which we will put and glue the fibre has tolerance of just $2 \mu\text{m}$ and in case for single mode fibre even $1 \mu\text{m}$ only. As already mentioned the outer diameter of the bare fibre is $125 \mu\text{m}$.

One can imagine, that such precision requires special tools for the bonding process as well as for the subsequent grinding and polishing process.

2.0 Prepare the fibre

Before can mate a connector to the fibre, it must be prepared as it is illustrated in the next steps



Remove the cladding

The fibre is protected by an acrylic buffer coating which needs to be removed using the miller pliers. They are just a more precise cable stripper tool and acts in the same way.



Clean with Isopropanol and KIM wipes

This is a very important step and should not be skipped. A KIM wipe is moistened with isopropyl alcohol ...



and the stripped fibre is cleaned.

If this step is skipped, small particle from the acrylic buffer may adhere at the fibre and will prevent to slip the fibre into the ferrule, since there is only space of $1\ \mu\text{m}$ (see Fig. 1).



Test if the fibre goes smoothly into the ceramic ferrule

Now we are testing if the fibre is cleaned sufficiently cleaned. The fibre is inserted into the connector as shown in the picture on the left. There should be no perceptible resistance.

We remove the fibre from the connector and perform the next step.

3.0 Prepare the bonding

The glue consists out of two components, the bond and the activator. The bonding takes only place once the bond come into contact with the activator.



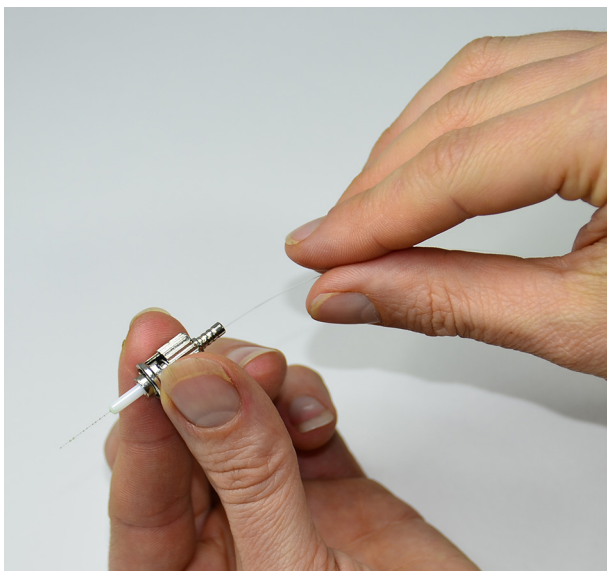
Fill the provided syringe with a bit of the “bond”.



Insert the needle of the syringe into the connectors until it stops. Now fill the ceramic ferrule from the back side with the bond until a small drop of the bond appears at the tip of the ferrule.



Put the connector aside and dip the fibre into the accelerator.



Slip the fibre into the ferrule until it stops. Wait a couple of seconds and the bonding process is finished.

4.0 Scratch and break the fibre

The next steps serves for the preparation of the polishing process.

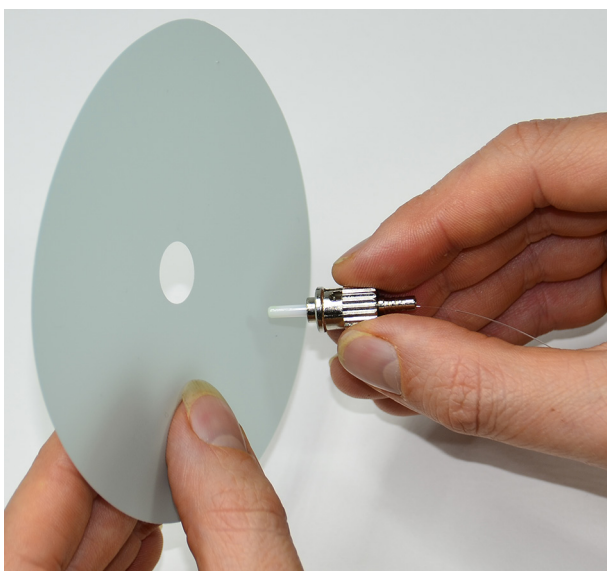


The protruding piece of fibre needs to be removed. For this purpose the cleaving tool is used. It has a very sharp and hard tungsten blade. Slightly above the bluish bond bump set the blade and transverse it along the fibre. With a small radial push the fibre will break.



The fibre has been broken apart and is now ready for the next step.

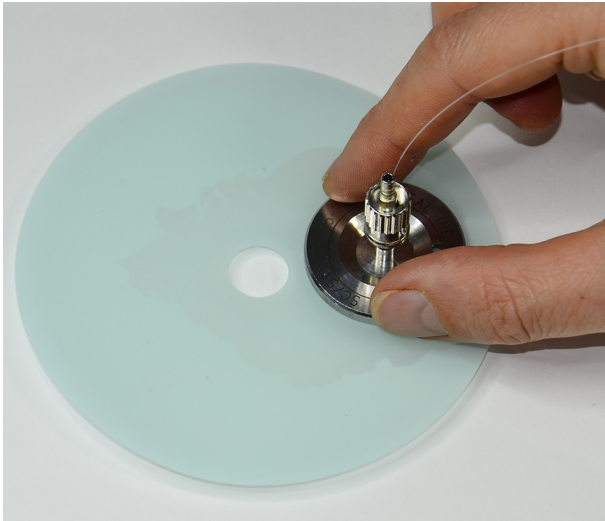
5.0 Grinding and Polishing the fibre



An underestimated, but important part is the so called “air polishing”. During the breaking process the fibre might not been broken perfectly and may have sharp peaks. These undesired parts will be removed by the air polishing as shown in the figure on the left. The connector is moved while gently touching the polishing paper.



In the next step the polishing support is prepared. On top of the acrylic plate we add a few drops of water at that spot where the polishing paper shall be placed and fixed.



The polishing paper has a glossy and a matt finished side, the polishing side. The paper is set onto the plate with the glossy side, due to the water it adheres perfectly.

Take the polishing jig and place it onto the polishing paper. Insert the connector into it and start with gentle polishing movements following a shape of an eight. After ten or so movements the connector may be touched in addition and gently pressed down (gently).

After another ten movements the first inspection of the fibre takes place.

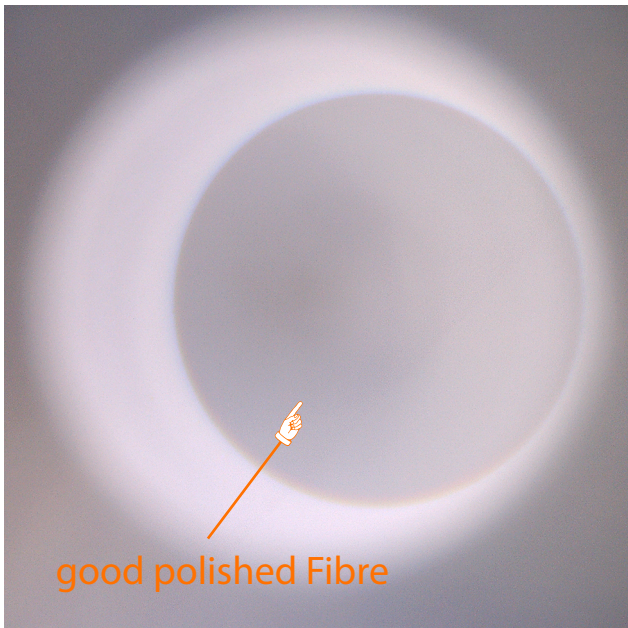
6.0 Inspecting the fibre connector



Before inserting the connector into the microscope clean tip of connector carefully with a moistened (Isopropyl alcohol) wipe.



Place the fibre connector into the ferrule holder at the bottom of the microscope. Look into the ocular while pressing the knob to illuminate the fibre. Turn the knurled knob and adjust the focus for a clear picture.



If you see such a fibre face, you made an excellent job. There are no scratches and digs.



If you shine light into the fibre or simply hold the end of the fibre into the direction of a light source, the core will transport the light as it can be seen on the illustration on the left. The dimensions are typical for a multimode fibre. The outer diameter is 125 μm and the core diameter 50 μm , almost half of the fibre diameter.

7.0 Safety aspects

Make sure that residual fibre splinters are deposited into the provided scrap can using the tweezers wherever applicable.