Photonic-crystal fiber:

A photonic crystal fiber (also called *holey fiber*, *hole-assisted fiber*, *microstructure fiber*, or *microstructured fiber*) is an optical fiber which obtains its waveguide properties not from a spatially varying glass composition but from an arrangement of very tiny and closely spaced air holes which go through the whole length of fiber. Such air holes can be obtained by using a preform with (larger) holes, made e.g. by stacking capillary and/or solid tubes (*stacked tube technique*) and inserting them into a larger tube. Usually, this preform is then first drawn to a *cane* with a diameter of e.g. 1 mm, and thereafter into a fiber with the final diameter of e.g. 125 µm. Particularly soft glasses and polymers (plastics) also allow the fabrication of preforms for photonic crystal fibers. There is a great variety of hole arrangements, leading to PCFs with very different properties.

The simplest (and most often used) type of photonic crystal fiber has a triangular pattern of air holes, with one hole missing (see Figure 1), i.e. with a solid core surrounded by an array of air holes. Solid core photonic crystal fiber guided light by modified total internal reflection (M-TIR).The guiding properties of this type of PCF can be roughly understood with an *effective index model*: the region with the missing hole has a higher effective refractive index, similar to the core in a conventional fiber.

There are also so-called photonic bandgap fibers (PBG fibers) with a totally different guiding mechanism, based on a photonic bandgap of the cladding region. The latter mechanism even allows guidance in a hollow core (i.e. in a low-index region), such that most of the power propagates in the central hole. They typically guide light only in a relatively narrow wavelength region with a width of e.g. 100–200 nm and can be used e.g. for pulse compression with high optical intensities, as most of the power propagates in the hollow core.

Most PCFs are made of pure fused silica (→ *silica fibers*), which is compatible with the above-mentioned fabrication techniques. However, various PCFs made of other materials have been demonstrated, most notably of heavy metal soft glasses and of polymers (*plastic optical fibers*).

Figure 1: A frequently used solid-core photonic crystal fiber design. There is a triangular pattern of air holes, where the central hole is missing. The gray area indicates glass, and the white circles air holes with typical dimensions of a few micrometers. Only the region around the core is shown.

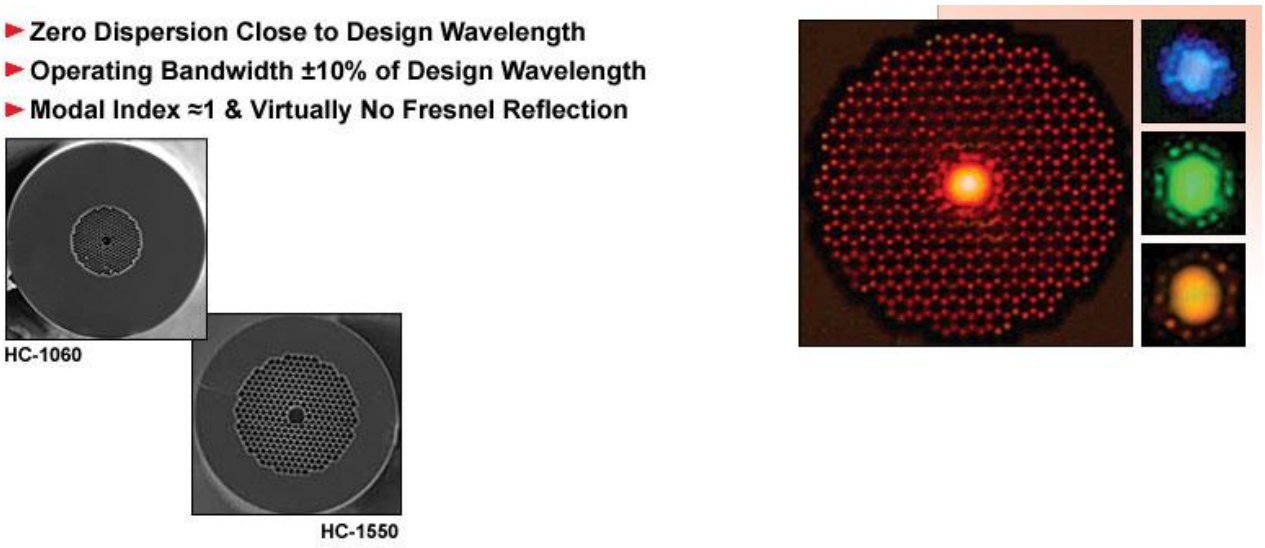
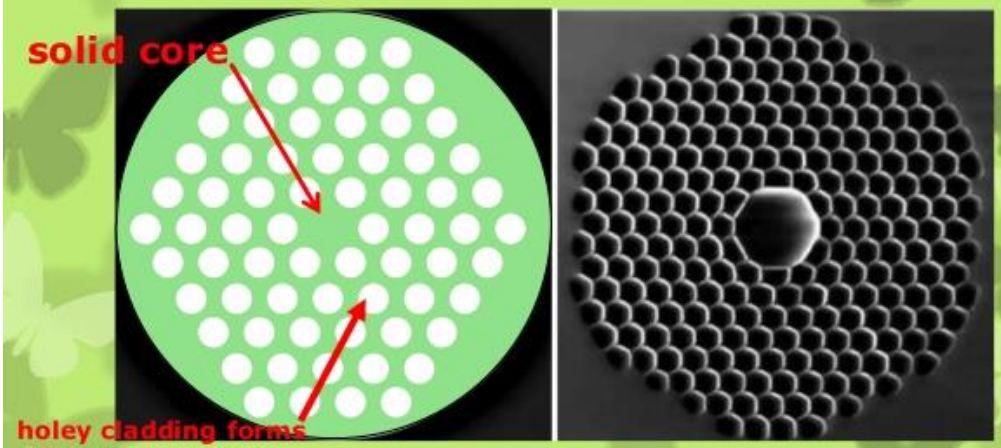


Fig.(2):Hollow Core Photonic Crystal Fibers

Photonic crystal fibers

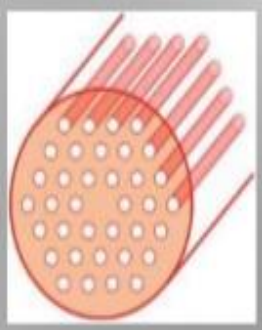
Photonic crystal fibers combine properties of 2D photonic crystals and classical fibers.lattice pitch, air hole shape and diameter, refractive index of the glass, and type of lattice determines the properties of the fiber. (Generally Silica)
There are two guiding mechanisms in PCF: index guiding mechanism (similar to the one in classical optical fibers) and the photonic bandgap mechanism.



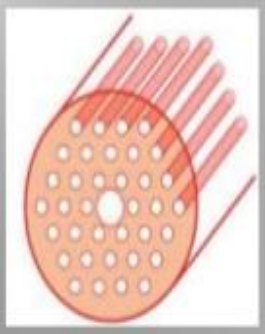
Solid core and Hollow core PCFs (http://spie.org/x31636.xml)

CLASSIFICATION OF PCF

High Index Guiding Fiber
(use modified total internal reflection)



Low Index Guiding Fiber
(use photonic band gap effect)



Endlessly Single Mode