

Optical Fibres – Lesson Outline

Syllabus References

- 9.9.1.3.2 - Gather secondary information to identify the desirable optical properties of silica, including:
- refractive index
 - optical non-linearity
 - ability to form fibres

Resources

Video: Introduction to optical fibres
<http://www.hscphysics.edu.au/resource/FibreIntro.flv>

Video: Optical fibres: guiding light
<http://www.hscphysics.edu.au/resource/GuidingLight.flv>

Video: Making a fibre
<http://www.hscphysics.edu.au/resource/MakingAFibre.flv>

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Activities

Activity: Cloze passage. Students complete the cloze passage individually.

Split students into groups of three. Hand out butcher's paper and a marker. In groups, students answer the question: Describe the optical properties of silica, including the refractive index, ability to form fibres, and optical non-linearity.

View Video

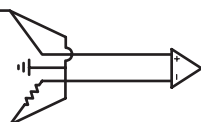
Video: Optical fibres: guiding light
<http://www.hscphysics.edu.au/resource/GuidingLight.flv>

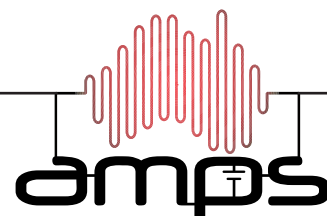
Activities

Lead student discussion: how does an optical fibre guide light? What role does the core play? What does the refractive index describe?

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Video: Making a fibre
<http://www.hscphysics.edu.au/resource/MakingAFibre.flv>





Optical Fibres - cloze passage

Glass is very _____ – it is like honey. Glass can easily be melted, so uniform optical _____ can be drawn from large scale glass structures. That is the whole basis for the fabrication of optical fibres. Physicists can scale down _____ - these larger glass structures - by heating them to the _____ temperature.

In the middle of the fibre is a _____ that is a slightly different colour. That's called the _____ of the fibre. Surrounding the core is the _____. The core actually includes a slightly different composition of material – _____ material.

The core has a higher _____. Thus light is guided through _____ internal reflection.

Imagine a laser beam being shone down an optical fibre. If the laser beam is very _____, then the _____ field associated with that light beam will _____ the underlying atoms and molecular structure of the glass. It will change the properties. That's referred to as an optical _____.

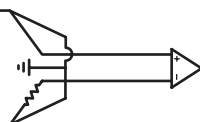
An example of an optical non-linearity is the _____ that were invented a few decades ago: when you walked outside, they would _____ and so that the sunlight would be attenuated. But if you went in a room they would become more _____. So it is the material that is changing its properties depending on the _____ of the light.

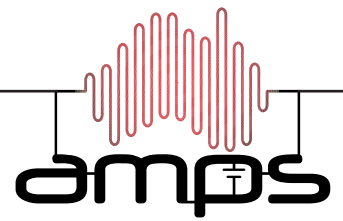
Optical non-linearities can be both very important and useful. As well as these sunglasses we can also use these non-linearities to do a range of interesting _____ processing applications.

More often than not, these optical non-linearities are a nuisance because when we send _____ of laser light through hundreds of kilometers of _____, these tiny optical nonlinearities become very, very significant. They tend to _____ the information quality.

_____ has a very low optical nonlinearity. In many ways it is the _____ material for doing transmission of optical systems, because it has low loss and the optical nonlinearities are very low. However, these nonlinearities still accumulate over _____ of _____.

_____ can be made from a whole range of materials. For example, some Australian physicists are working on making fibres from arsenic and selenide. These fibres will be _____ in the mid-infrared, which is an important region of the electromagnetic _____ for defense and sensing. Other Australian physicists are making optical fibres from _____. These fibres are not as transparent as _____, however they are much cheaper, with a lower melting point and easier _____.





Word list:

- Intense
- Fabrication
- Silica
- Intensity
- Core
- Spectrum
- Transparent
- Plastic
- Ideal
- Distort
- Cladding
- Non-linearity
- Darken
- Sunglasses
- Signal
- Doped
- Kilometres
- Total
- Destroy
- Fibre
- Pulses
- Silica
- Refractive Index
- Thousands
- Viscous
- Fibres
- Preforms
- Melting
- Drawn
- Electromagnetic
- Region
- Optical Fibres

