

614-0805 (50-330) Polarization Slides

Introduction: Polarization is a property of electromagnetic emissions that describes the orientation of their oscillations. For the purposes of this experiment, we will be concerned with light. Light from most sources is not polarized. This means that while a ray of light travels forward, the direction of the oscillations can be any angle.

In unpolarized light, the angle of the ray is random. Polarized light is a ray whose oscillations are set at a specific angle. You can take a light ray and separate it into its horizontal and vertical components. Then angle of the ray is always perpendicular to the direction the ray is traveling. To physically separate the ray, you will need a material known as a polarizing filter.

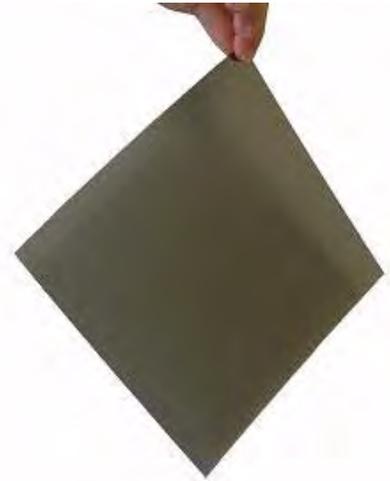
A polarizing filter contains long strands of molecules, arranged horizontally or vertically. These are arranged very close together, close to the wavelength of visible light. This creates a “picket fence” effect. When light strikes the material, it can only pass through in one direction due to the strands. The strands absorb light, while the slits between them allow it through, forcing the light to move in the same direction. Sunglasses sometimes use this property to reduce the scattering of light, making it easier on the eyes by cutting glare.

One polarizing lens can cut glare, but multiple lenses have interesting effects. Place the slides on top of each other. What happens? It depends on the orientation of the slides relative to each other. If the filters are aligned the same way, most of the light will pass through. Rotate one of the slides. As the orientation of the two slides approaches 90° , less and less light will pass through the filters. When the two slides are perfectly perpendicular to each other, they will become perfectly opaque.

Why does this happen? Consider the picket fence model. When light is polarized, it oscillates in one angle only. If two filters are used, it is possible to align them so that light cannot move through at all. The light that escapes from the slits on the first filter is caught by the absorbent strips on the second filter. By adjusting the relation of the two filters to each other, it is possible to control the amount of light coming through.

If one uses more than two filters, some interesting effects emerge. For example, if two filters are set up in such a way as to be completely opaque, a third can be used to allow some light through. How is this possible? The third filter must be between the first two. You can use it to “twist” the light coming out of the first filter so that it is no longer entirely parallel to the absorbent strands on the second filter. Placing the middle filter at a 45° angle with relation to the other two will allow the most light to pass. Adding more filters allows more light through.

Operation: There are a number of experiments you can perform using your polarization slides. The simplest demonstration is to take the slides and slowly rotate one against the other, showing how the two become more and more opaque.



Another method is to use an LCD screen. Liquid Crystal Displays naturally produce polarized light. They are found in computer monitors and calculator screens. You can easily use one of the slides to produce an opaque effect.

A very interesting experiment requires a laser. Lasers by definition produce polarized light. Set up a laboratory laser on a table. A few feet away place one of the slides, in such a way that it blocks as much of the laser light as possible. Then, place the second slide in between the laser and the first slide. Move it until as much laser light as possible is passing through the filters. Your students will be amazed at this apparent contradiction.

Warranty and Parts:

We replace all defective or missing parts free of charge. Additional replacement parts may be ordered toll-free. We accept MasterCard, Visa, checks and School P.O.s. All products warranted to be free from defect for 90 days. Does not apply to accident, misuse or normal wear and tear. Intended for children 13 years of age and up. This item is not a toy. It may contain small parts that can be choking hazards. Adult supervision is required.