

Liquid Crystal Sheet: Information & Instructions

How do the liquid crystal sheet work?

Liquid crystals (LCs) **selectively reflect** light, which means that when white light (from the sun or a lightbulb) shines on them, most of the wavelengths of light (colors) pass right through, but part of the light (a select color) gets reflected back. The color of the light that gets selectively reflected changes as a function of temperature for some LCs, such as the ones in the sheet you've been given. See the Optics Suitcase presentation guide for more information how these LCs work.

The LC sheet you have been provided is constructed of a sheet of Mylar covered with black ink and LCs. The ink provides a dark background which absorbs any light transmitted through the LCs and allows the light selectively reflected by the LCs to be viewed without interference. The LCs are dispersed in a polymer matrix, which forms tiny (3-5 μ m) capsules around them. This protects the LCs from contamination by dust, smudges, water, etc., which would cause unprotected liquid crystals to lose their characteristic properties within a matter of days or weeks. The LC sheet you have been should maintain its color changing properties for years if handled properly (see below for details).

How to use the liquid crystal sheet

The LC sheet you have been provided is ready for immediate use. It exhibits selective reflection through the total color spectrum in the 77-86⁰F (25-30⁰C) temperature range (from red at cooler temperatures, to blue at warmer temperatures). This is right around the temperature range of your fingers, so a good way to begin using the sheet is to simply pick it up and watch how the heat from your hand warms up the liquid crystals as you handle the sheet. Other experiments you might try include:

- Try writing your name on the sheet using your finger.*
- Hold the sheet to your fingers, your wrist, your face, and notice your skin surface temperature varies at different location on your body.
- See how the temperature of your fingers changes after you hold a heat pack or a cold glass.
- Doctors can use LCs to study circulation in the body. Hold the sheet against your wrist or arm and see if you can find any veins. See the Optics Suitcase presentation guide (page 12) for a discussion of how this has been used to study the effects of smoking.
- If the whole sheet becomes warm (>86⁰F), all you will see is a very deep blue. This may happen if the room is very warm, if you heat the sheet up with a lamp, or if you warm it up with your skin. To change its color, try writing on the warm LC sheet using an icecube or a finger dipped in cold water. Watch how the effects of heating are reversed.
- Try testing how heat flows through objects with different structure. Find, for example, something with a honeycomb structure, a flat surface made up of different types of metal or plastic, or a flat surface with different thicknesses. Place the LC sheet in direct contact with the object. Slowly apply heat to the opposite side of the object using a light or a heat pack. Heat will flow through the object to the surface with the LC film, but because it will encounter different thermal conductivity values along the way, the LC sheet will show structural characteristics of the object.

Note: On a hot day or in a very warm room, the LC sheet may reach the deep blue end of the spectrum at room temperature or with very little handling. If this happens you will need to cool down the sheet before doing any demonstrations. For this reason ***it is a good idea to have ice or a cold pack with you when you plan to use this material.***

*Because the LCs in the sheet you have been provided are encapsulated, they are well protected, and your LC sheet should be very durable. However, ***the sheet can be damaged or ruptured if subjected to abnormal pressure (such as that exerted by a ball point pen or other sharp object) or temperatures higher than 125⁰C.***

Adapted by A. Marino and S. Jacobs from the Edmund Industrial Optics Information & Instructions Sheet for Stock Nos. 72-370-5
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