Exploring Materials—Thin Films

Can clear things be colorful?

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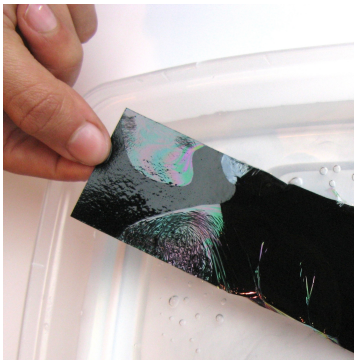
Try this!

1. Write your name on a strip of black paper.
2. Slide the paper into the pan. Make sure it's completely under water.
3. Use the brush to drip one drop of nail polish onto the surface of the water. The polish will spread out into a thin film.
4. Hold one end of the paper and lift it up out of the water. The film of nail polish will stick to the paper. Does the nail polish still look clear?

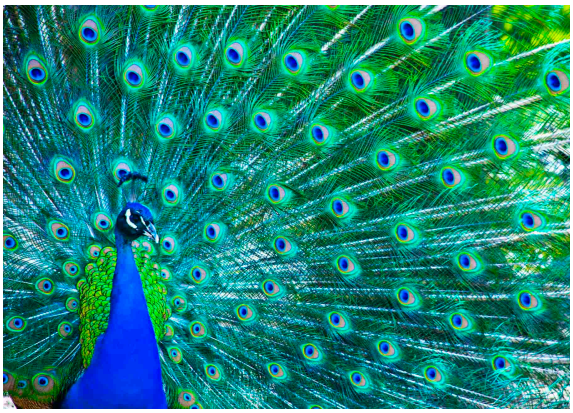


What's going on?

The nail polish spreads out into a super-thin film, which creates iridescent, rainbow colors on the paper. The thin film is only a few hundred nanometers thick, about as thick (or thin!) as a soap bubble. The film is slightly thicker in some places and thinner in others. As the thickness of the film changes, the color changes.

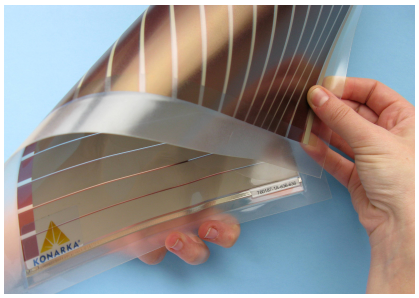
The film reflects light differently depending on how thick it is, so you see different colors. White light is made up of all wavelengths, or colors, of light. Wavelengths that are in sync, hitting both the front and back of the film, are reflected back to your eyes as bright colors. Different wavelengths are in sync at different parts of the film, depending on its thickness.

Many beautiful things in nature get their iridescent colors this way—through the constructive interference of light. Bird feathers, butterfly wings, shells, and beetle shells all have nano-sized, semi-transparent layers that create an iridescent effect when they reflect light.



Peacock feathers are iridescent

How is this nano?



Thin film solar panel

The way a material behaves on the macroscale is affected by its structure on the nanoscale. Thin films can reflect light in special ways, because they're only a few hundred nanometers thick—in the same size range as the wavelength of visible light.

Nanotechnology takes advantage of special properties at the nanoscale to create new materials and devices. Researchers are creating thin film batteries, solar cells, electronic displays, and coatings for different surfaces.