

Purple light means go, ultraviolet light means stop

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A new membrane developed at the University of Rochester's Laboratory for Laser Energetics blocks gas from flowing through it when one color of light is shined on its surface, and permits gas to flow through when another color of light is used. It is the first time that scientists have developed a membrane that can be controlled in this way by light.

Eric Glowacki, a graduate student at the University's Laboratory for Laser Energetics, and Kenneth Marshall, his advisor, invented the membrane. Marshall will present their findings at the annual conference of the International Society for Optics and [Photonics](#) (SPIE) in San Diego on Aug. 1.

The membrane is a piece of hard plastic riddled with tiny holes that are filled with liquid crystals and a dye. When purple light illuminates the surface of the membrane, the [dye molecules](#) straighten out and the liquid crystals fall into line, which allows gas to easily flow through the holes. But when [ultraviolet light](#) illuminates the surface, the dye molecules bend into a banana shape and the liquid crystals scatter into random orientations, clogging the tunnel and blocking gas from penetrating.

Controlling a membrane's [permeability](#) with light is preferable to controlling it with heat or electricity - two readily used alternative methods - for several reasons, Glowacki said. For starters, light can operate remotely. Instead of attaching electrical lines to the membrane, a lamp or a laser can be directed at the membrane from a distance. This could allow engineers to make much smaller, simpler setups.

Another advantage is that the color of the light illuminating the membrane can be changed precisely and almost instantaneously. Other methods, like heating and cooling, take a relatively long time and repeated heating and cooling can damage the membrane.

Also, light does not have the potential to ignite a gas, which could be a crucial benefit when working with hydrocarbons or other flammable gases. Lastly, the amount of light energy needed to switch the membrane on and off is miniscule.

Creating the membrane is a multi-step process. First, a circular hard plastic chip is bombarded with a beam of neutrons to make the tiny, evenly spaced holes that are about one-hundredth of a millimeter in diameter. The chip is then dipped in a solution of liquid crystals and dye, and the mixture fills the holes through capillary action. The final product is spun in a centrifuge to remove the excess liquid crystals from the surface.

The membrane could be useful in controlled drug delivery and industrial processing tasks that require the ability to turn the flow of [gas](#) on and off as well as in research applications.

Provided by University of Rochester

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