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If you think it's tough now to break through the plastic wrap on a new CD or DVD, just wait. The protective polymers surrounding your favorite products soon may be working even harder to keep your food, medications and even electronics safer and fresher longer—at less cost.

Polymers, such as polyethylene, polypropylene and nylon, are broadly used as gas barriers for food, medicine and even electronics packaging because they're low in cost, durable and easy to produce. Now, a study by researchers at Case Western Reserve University reveals a nanotechnology method that could block damaging gases even more effectively.

"The work takes a step toward developing more flexible, optically transparent, ultra-high-barrier polymers for several different applications," said Anne Hiltner, Ph.D., lead author of the study and the Herbert Henry Dow Professor of Science and Engineering at Case Western Reserve. The study was conducted in the labs of the National Science Foundation Center for Layered Polymeric Systems at the School of Engineering, where Hiltner is co-director.

Researchers found that when melted into nanolayers, polyethylene oxide, a standard ingredient in polymer production, crystallizes as a single, very thin, but very strong layer made up of large, impermeable "single" crystals, dramatically reducing gas permeability in numerous polymer applications. The team also discovered that this new polymer structure results in progressively thinner layers, thereby saving material and cost.

Crystalline polymers are characterized by chains of repeating molecules that line up very closely to one another in well defined, ordered patterns, much as water molecules do when they form ice. Crystalline polymers do not allow even the smallest gas molecules, such as oxygen or carbon dioxide, to permeate the barrier they create.

"This spontaneous organization of a polymer melt into large, nearly perfect, single crystals has not been observed before this study, according to Benny Freeman, the Kenneth A. Kobe Professor of Chemical Engineering at the University of Texas at Austin and co-author of the study.

The study's findings are published in the Feb. 6, 2009, issue of the journal *Science*.

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