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New material may improve Arrow LionHeart

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Researchers at Penn State might have developed a way to improve the Arrow LionHeart by refining the material that makes up its components.

A polymer used for biomedical applications such as implants and the LionHeart, developed at Penn State in cooperation with biotechnology company Arrow International, Inc., might now have an improved permeability, limiting the amount of liquid or gas that can pass through it.

In the case of the LionHeart, air and or blood gradually leak out, decreasing the efficiency of the artificial heart's components, such as the pumping chamber, said James Runt, professor of polymer science. Water and other liquids from the body also can leak inward, damaging the electronics of the device.

"(Hypothetically,) this will decrease maintenance," Runt said.

Aside from the biomedical uses such as the artificial heart and bone and breast implants, the polymer also can be used commercially, such as for car parts or the packaging of soda, he said. "The general principles can be used in any rubber or polymer."

The polymer has yet to be tested for fatigue resistance as the researchers seek more funding for their project.

The polymer was developed through the trial-and-error of two distinct methods in the research, which started 18 months ago.

Originally, researchers used a chemical method in which they mixed the standard polymer, made of urethane urea, with polyisobutylene. Acting as the backbone to the comb-like structure formed, it was hoped that the polymer, along with the polyisobutylene, would create a barrier against air and water.

The method worked, but "(there was) a lot of painstaking chemistry for relatively small return," Runt said.

A balance must be found when developing the polymer, said Evangelos Manias, assistant professor of materials science. "We do not want water to go through, but we want it to be strong," he said.

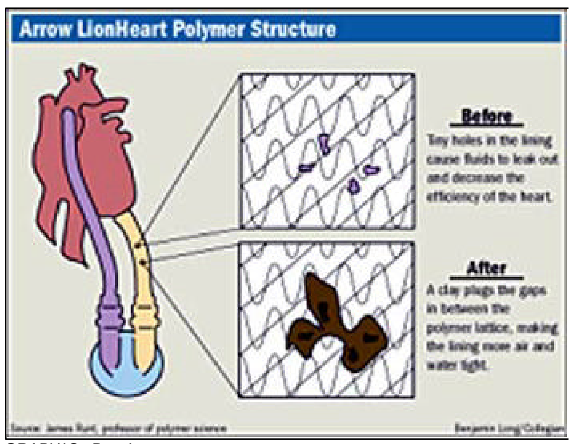
In the chemical method, the filler sacrificed the mechanical properties of the polymer, such as its elasticity and strength, Manias said. This is bad because along with permeability, the polymer needs to be flexible and shapeable for its different uses.

"You want to keep that flexible character," Runt said.

Next, researchers used what is called the nanocomposites approach. A commercial silicate clay was mixed with the polymer in a solvent, and then the solvent was removed. Layers of the clay remained distributed in the polymer like tiny platelets do in the bloodstream, patching up the openings, Runt said.

This method was successful because the nanocomposites were small enough so that the polymer could be bent without losing its mechanical properties.

In addition, "this gave rise to a more significant reduction in permeability by a factor of five," Runt said.



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