Universidade Federal do Pampa
Campus Bagé

Pró-reitoria de Pesquisa, Pós-Graduação e Inovação

Curso de Licenciatura em Letras: Línguas Adicionais

Teste de Proficiência em Inglês

Edital 220/2017

2 de agosto de 2017

CPF:

O objetivo deste teste é comprovar sua proficiência em leitura e compreensão de textos em língua inglesa. Para tanto:

1) Leia atentamente os textos 1 e 2 e as questões referentes aos textos;
2) Baseie-se somente no texto para responder as perguntas;
3) Utilize somente dicionário **impresso**.

Antes de começar o exame, certifique-se de que:

1) Desligará seus equipamentos eletrônicos;
2) Escreverá com caneta azul ou preta;
3) Utilizará somente as folhas de rascunho fornecidas;
4) Ao final da prova, entregará ao examinador a prova e as folhas de rascunho.

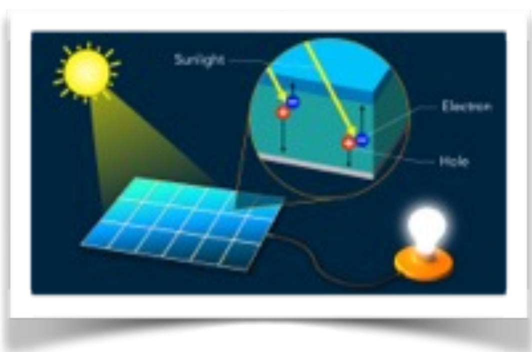
Leia os dois textos de referência e depois responda aos questionamentos que os seguem. São 7 (sete) perguntas com pontuação máxima de 5 (cinco) relativas ao primeiro texto e 4 (quatro) perguntas com pontuação máxima de 5 (cinco) relativas ao segundo. São 10 pontos ao total.

A duração da prova é de 03 (três) horas.

Text 1: Atomic Movies May Help Explain Why Perovskite Solar Cells Are More Efficient
SLAC's ultrafast "electron camera" reveals unusual atomic motions that could be crucial for the efficiency of next-generation perovskite solar cells.
Stanford News, Written by: Manuel Gnida
July 26, 2017

In recent years, perovskites have taken the solar cell industry by storm. They are cheap, easy to produce and very flexible in their applications. Their efficiency at converting light into electricity has grown faster than that of any other material – from under four percent in 2009 to over 20 percent in 2017 – and some experts believe that perovskites could eventually outperform the most common solar cell material, silicon. But despite their popularity, researchers don't know why perovskites are so efficient.

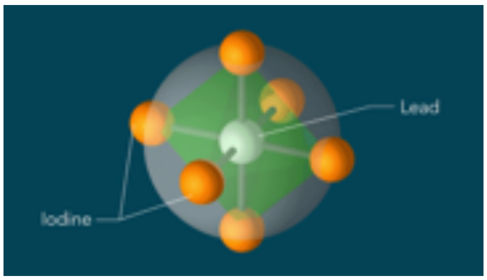
Now experiments with a powerful "electron camera" at the Department of Energy's SLAC National Accelerator Laboratory have discovered that light whirls atoms around in perovskites, potentially explaining the high efficiency of these next-generation solar cell materials and providing clues for making better ones. "We've taken a step toward solving the mystery," said Aaron Lindenberg from the Stanford Institute for Materials and Energy Sciences (SIMES) and the Stanford PULSE Institute for ultrafast science, which are jointly operated by Stanford University and SLAC. "We recorded movies that show that certain atoms in a perovskite respond to light within trillionths of a second in a very unusual manner. This may facilitate the transport of electric charges through the material and boost its efficiency." The study was published today in *Science Advances*.



Light Sets Atomic Structure in Motion
When light shines on a solar cell material, its energy displaces some of the material's negatively charged electrons. **This** leaves behind "electron holes" with a positive charge where the electrons were originally located. Electrons and holes migrate to opposite sides of the material, creating a voltage that can be used to power electrical devices. A solar cell's efficiency depends on how freely electrons and holes can move in the material. Their mobility, in turn, depends on the material's atomic structure. In silicon solar cells, for example, silicon atoms line up in a very orderly fashion inside crystals, and even the smallest structural defects reduce the material's ability to efficiently harvest light. As a result, silicon crystals must be grown in costly, multistep procedures under extremely clean conditions. In contrast, "Perovskites are readily produced by mixing chemicals into a solvent, which evaporates to leave a very thin film of perovskite material," said Xiaoxi Wu, the study's lead author from SIMES at SLAC. "Simpler processing means lower costs. Unlike silicon solar cells, perovskite thin films are also lightweight and flexible and can be easily applied to virtually any surface."

But what exactly is it about perovskites that allows some of them to harvest light very efficiently? Scientists think that one of the keys is how their atoms move in response to light.

To find out more, Wu and her colleagues studied **<u>these</u>** motions in a prototype material made of iodine, lead and an organic molecule called methylammonium. The iodine atoms are arranged in octohedra – eight-sided structures that look like two pyramids joined at their bases. The lead atoms sit inside the octohedra and the methylammonium molecules sit between octohedra.



<u>This</u> architecture is common to many of the perovskites investigated for solar cell applications. "Previous studies have mostly explored the role of the methylammonium ions and their motions in transporting electric charge through the material," Wu said. "However, we've discovered that light causes large deformations in the network of lead and iodine atoms that could be crucial for the efficiency of perovskites."

Unusual Distortions May Enhance Efficiency

At SLAC's Accelerator Structure Test Area (ASTA), the researchers first hit a perovskite film, less than two millionths of an inch thick, with a 40-femtosecond laser pulse. One femtosecond is a millionth of a billionth of a second. To determine the atomic response, **<u>they</u>** sent a 300-femtosecond pulse of highly energetic electrons through the material and observed how the electrons were deflected in the film. This technique, called ultrafast electron diffraction (UED), allowed them to reconstruct the atomic structure. "By repeating the experiment with different time delays between the two pulses, we obtained a stop-motion movie of the lead and iodine atoms' motions after the light hit," said co-author Xijie Wang, SLAC's lead scientist for UED. "The method is similar to taking a series of ultrafast X-ray snapshots, but electrons give us much stronger signals for thin samples and are less destructive."

"The results from the Lindenberg group provide fascinating first-time insights into the properties of hybrid perovskites using ultrafast electron diffraction as a unique tool," according to Felix Deschler, an expert in the field of light-induced physics of novel materials and a researcher at Cambridge University's Cavendish Lab, who was not involved in the study. "Knowledge about the detailed atomic motion after photoexcitation yields new information about their performance and can provide new guidelines for material development."

This work was funded by the DOE Office of Science through SIMES. Other contributors came from the University of Pennsylvania, Columbia University and the Weizmann Institute of Science in Israel.

Citation: X. Wu *et al., Science Advances*, 26 July 2017 (10.1126/sciadv.1602388)

Disponível em: <<u>https://www6.slac.stanford.edu/news/2017-07-26-atomic-movies-may-help-explain-why-perovskite-solar-cells-are-more-efficient.aspx</u>>. Acesso em: 31 de julho de 2017

Respondas as questões sobre o texto 1:

Questão 1 **–** Baseado no texto responda a pergunta: por que as células solares Perovskite podem ser mais eficientes na fabricação de painéis solares do que as células solares de silicone? (0,5)

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Questão 2- Escreva a quem ou a que as expressões em negrito abaixo se referem no texto. (1)

"**This** leaves behind "electron holes" (linha 20, p. 2)	
"**these** motions in a prototype material" (linha 3, p. 3)	
"**This** architecture is common" (linha 7, p.3)	
"**they** sent a 300-femtosecond pulse of highly energetic electrons" (linha 19, p. 3)	

Questão 3 – Quem é Xiaoxi Wu? Explique com todas as informações que o texto fornece. (0,5)

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Questão 4 – Baseado no texto, explique o que é e como funciona a técnica UED usada na pesquisa sobre a eficiência das células solares Perovskite. (1)

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Questão 5 – Baseado no texto, explique em nível atômico como funcionam as placas solares, isto é, explique como as placas solares geram energia elétrica em nível atômico. (1)

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Questão 06: De acordo com Felix Deschler, quais seriam as contribuições da pesquisa sobre as células solares Perovskite? (0,5)

Questão 07: Reescreva, em português, o segmento de texto a seguir. Lembre-se de manter o texto claro em português, isto é, que faça sentido e esteja estruturalmente adequado. (0,5)

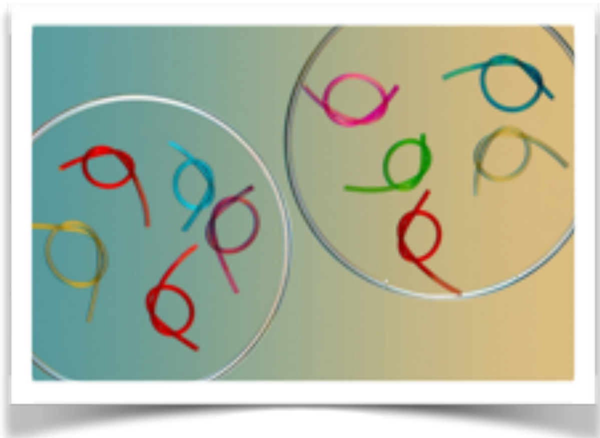
"By repeating the experiment with different time delays between the two pulses, we obtained a stop-motion movie of the lead and iodine atoms' motions after the light hit," said co-author Xijie Wang, SLAC's lead scientist for UED. "The method is similar to taking a series of ultrafast X-ray snapshots, but electrons give us much stronger signals for thin samples and are less destructive." (linhas 22 a 24, p. 3).

Text 2: New gel coatings may lead to better catheters and condoms

Bonded layers of rubber and hydrogel yield tough, slippery, and impermeable coatings.

Jennifer Chu | MIT News Office

July 18, 201



Catheters, intravenous lines, and other types of surgical tubing are a medical necessity for managing a wide range of diseases. But a patient's experience with such devices is rarely a comfortable one. Now MIT engineers have designed a gel-like material that can be coated onto standard plastic or rubber devices, providing a softer, more slippery exterior that can significantly ease a patient's discomfort. The coating can even be tailored to monitor and treat signs of infection.

In a paper published today in the journal *Advanced Healthcare Materials*, the team describes their method for strongly bonding a layer of hydrogel — a squishy, slippery polymer material that consists mostly of water — to common elastomers such as latex, rubber, and silicone. The results are "hydrogel laminates" that are at once soft, stretchable, and slippery, and impermeable to viruses and other small molecules. The hydrogel coating can be embedded with compounds to sense, for example, inflammatory molecules. Drugs can also be incorporated into and slowly released from the hydrogel coating, to treat inflammation in the body.

The team, led by Xuanhe Zhao, the Robert N. Noyce Career Development Associate Professor in the Department of Mechanical Engineering at MIT, bonded layers of hydrogel onto various elastomer-based medical devices, including catheters and intravenous tubing. They found that the coatings were extremely durable, withstanding bending and twisting, without cracking. The coatings were also extremely slippery, exhibiting much less friction than standard uncoated catheters — a quality that could reduce patients' discomfort. The group also coated hydrogel onto another widely used elastomer product: condoms. In addition to enhancing the comfort of existing latex condoms by reducing friction, a coating of hydrogel could help improve their safety, since the hydrogel could be embedded with drugs to counter a latex allergy, the researchers say. "We've demonstrated hydrogel really has the potential to replace common elastomers," Zhao says. "Now we have a method to integrate gels with other materials. We think this has the potential to be applied to a diverse range of medical devices interfacing with the body."

Zhao's co-authors are lead author and graduate student German Parada, graduate students Hyunwoo Yuk and Xinyue Liu, and visiting scientist Alex Hsieh.

A tailored gel

Zhao's group previously developed recipes to make tough, stretchable hydrogels from mixtures composed mostly of water and a bit of polymer. They developed a technique to bond hydrogels to elastomers by first treating surfaces such as rubber and silicone with benzophenone, a molecular solution that, when exposed to ultraviolet light, creates strong chemical bonds between the elastomer and the hydrogel.

The researchers applied these techniques to fabricate a hydrogel laminate: a layer of elastomer sandwiched between two layers of hydrogel. They then put the laminate structure through a battery of mechanical tests and found the structure remained strongly bonded, without tearing or cracking, even when stretched to multiple times its original length. The team also placed the laminate structure in a two-chamber tank, filled on one side with deionized water and the other with molecular dye. After several hours, the laminate prevented any dye from migrating from one side of the chamber to the other, whereas a layer of hydrogel alone let the dye through. The laminate's elastomer layer, they concluded, made the structure as a whole strongly impermeable — a feature they reasoned could also prevent viruses and other small molecules from passing through.

Tying knots

As a first foray into possible applications for hydrogel laminates, the researchers used their previously developed techniques to coat hydrogel onto various elastomer devices, including silicone tubing, a Foley catheter, and a condom. "Our first major focus was catheters, because they are rigid and not very comfortable, and infection of catheters can cause around 50 percent of readmissions to hospitals," Parada says. "We also thought we could apply this to condoms, because existing latex condoms cause lots of sensitivities and allergies, and if you can put drugs in the gel, you could have better protection." Even after sharply bending and folding the coated tubing into a knot, the researchers found the hydrogel coating remained strongly bonded to the tubing without causing any tears. The same was true when the researchers inflated both the coated catheter and the coated condom.

Parada says the dimensions of a hydrogel laminate may be tuned to accommodate different devices. For instance, scientists can choose a thicker elastomer to increase a laminate's rigidity, or use a thicker coating of hydrogel to incorporate more drug molecules or sensors. Hydrogels can also be designed to be more or less slippery, depending on the amount of friction desired.
"We have the capability to fabricate large-scale hydrogel structures that can coat medical devices, and the hydrogel won't agitate the body," Zhao says. "This is a technological platform onto which you can imagine many applications."

This research was funded, in part, by the Office of Naval Research, the MIT Institute for Soldier Nanotechnologies, and the National Science Foundation (NSF).

Disponível em: <http://news.mit.edu/2017/new-gel-coatings-better-catheters-condoms-0718>. Acessado em: 31 de julho de 2017

Responda as questões a seguir sobre o texto 2:

Questão 08: Depois de ler o texto cuidadosamente, escolha no mínimo 3 (três) palavras-chave em inglês para esta pesquisa. (1,5)

Questão 09: Conforme o texto, quais são as contribuições desta pesquisa para a área médica?(1)

Questão 10: De acordo com o texto, quais as vantagens da aplicação desta pesquisa especificamente em preservativos? (1)

Questão 11: Reescreva, em português, o segmento de texto a seguir. Lembre-se de manter o texto claro em português, isto é, que faça sentido e esteja estruturalmente adequado. (1,5)

"In a paper published today in the journal *Advanced Healthcare Materials*, the team describes their method for strongly bonding a layer of hydrogel — a squishy, slippery polymer material that consists mostly of water — to common elastomers such as latex, rubber, and silicone. The results are "hydrogel laminates" that are at once soft, stretchable, and slippery, and impermeable to viruses and other small molecules. The hydrogel coating can be embedded with compounds to sense, for example, inflammatory molecules. Drugs can also be incorporated into and slowly released from the hydrogel coating, to treat inflammation in the body." (linhas 12 a 18, p. 6).