


# **Sunny side up: How nanotechnology is transforming the solar industry**

By Joumana Al Rifai



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What do you picture when you hear about nanotechnology? Very possibly, Tony Stark's nano suit in The Avengers! That is how mainstream the discussion around what used to be niche technology has become.

At the start of the century, nanotechnology was considered the next big idea. Nano research has managed to cross scientific disciplines, finding numerous applications in chemistry, medicine, physics, and computer science. While the innovation in nano-related fields is awe-inspiring, its use is more impressive. From developing nanomaterials for the automotive industry through to its role in medical research and onto its practical application in solar cells – leading to the advancement of the solar industry and research concerning solar cell efficiency – the impact of this technology is truly life changing.

This brings us to two important questions: what does the term 'nano' imply, and how can nanotechnology help improve solar cell efficiency?

Let's look at some numbers: the prefix 'nano' is defined as one billionth; for example, one nanometer is 1/1,000,000,000 of a metre. Nanotechnology involves the fabrication of structures with dimensions within the range of one to a few hundred nanometers. That is small.

To put it in perspective, one human hair is approximately 20,000 nanometers in diameter. Structures fabricated in the nanoscale are the smallest human-made devices.

So, how can these tiny structures help improve solar efficiency?

The growing need for a sustainable, clean energy source has driven the interest in solar cell or photovoltaic technologies. The main challenge facing

the solar cell industry is its inability to compete, due to high cost and inefficiency, with the more traditional means of power generation. While cost can be reduced using certain materials, such as amorphous silicon-thin films, it comes at the expense of the cell's efficiency.

Current research trends suggest that incorporating nanotechnology will help improve solar cell efficiency, in addition to significantly lowering cell production costs.

Solar cell efficiency depends primarily on the amount of sunlight it is able to convert to electricity, with most of the losses occurring because only a small portion of the light is being captured, or because there is a reflection off the solar cell's surface or the material's absorption properties. Current research has been performed to limit these types of losses and, improve efficiency involves the use of nano-wires to increase absorption.

At Sorbonne University Abu Dhabi, we are collaborating with other institutions on unconventional methods to fabricate and utilise these nano-structures, for the improvement of cell efficiency. Concerns in conventional nano-structure fabrication processes involve the high temperature and fabrication cost. Another drawback of standard nano-structure fabrication techniques is the reliance on an etching process that results in material waste. Our goal is to produce solar cells that guarantee a high efficiency, while at the same time lowering fabrication costs, making the cell economically competitive.

So, yes, Tony's suit may be the first image that appears when you hear about nanotechnology. Now, when it's sunny outside, I hope the technology behind it will also come to mind.



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Dr Joumana El Rifai is an Assistant Professor of Physics at Sorbonne University Abu Dhabi. She is a strong proponent of the power of unique teaching methodologies in instilling a passion for STEM in future generations.