

Cooperation Is Crucial



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We talk to Dr. Ewelina Ciecierska, winner of the Maria Skłodowska-Curie award, about prize-winning nanofillers, the value of working in a group, and the presence of women in a traditionally male-dominated world

Academia: You are being graced with international-scale awards. You received the Pratt & Whitney Zbigniew Grabowski Memorial Prize for your PhD thesis, and have now been winning new acclaim. What is it like when one's scientific achievements meet with such appreciation?

Ewelina Ciecierska: *It's very pleasant. I feel appreciated, that what I do makes sense. It gives me satisfaction that this is not research along the lines of "let's try this and see what might come of it," but something viewed as having potential.*

You were awarded the Maria Skłodowska Curie prize by the French Embassy, the Institute Francais, and French corporations for "conducting polymer composites with carbon nanotubes." Can you explain what that means?

Composites are construction materials made of at least two components of differing properties. In typical composites one of the components works like a binder, enveloping another component that is responsible for the other mechanical properties. Nanocomposites are a particular kind of composites, where the size of at least one of the components is on the nanometer scale. There turns out to be a certain critical size for such nanofillers, below which the properties of a composite improve over traditional composites with the same composition. Even adding a small quantity of nanofillers can significantly improve the properties of a material. Polymers, such as epoxy resins, are a widely used binding material. They are very light, but on their own they are not very durable. Durability is imparted to polymer composites by the filler material, such as carbon nanotubes, a popular option that we investigate. These are rolled-up layers of graphene. They may consist of several layers, due to the properties of graphene. Nanotubes also give composites another property: the ability to conduct electricity and heat, which they are very effective at. When another form of carbon, highly conductive carbon soot, is added it needs to account for several percent of a composite, whereas the same conductivity can be achieved with just 1% nanotubes. In certain applications, the difference between one percent and several percent is of colossal importance.

In space, for instance? The French prize was funded by Thales Alenia Space...

Yes. It's a huge company, but the section that is interested in my work deals with satellite construction. The prize is a month-long research visit to the company's headquarters in Cannes. The research I have done to date was mainly related to materials for the aviation industry, and satellite-related issues are new to me. That is why I hope that we can strike up a longer cooperative relationship with Thales.

How did it all start? Where did you get the idea for the subject of your doctorate and later research?

The supervisor for my master's thesis proposed that I take part in a project at the Warsaw University of Technology. There we have a composite team that includes around 10 researchers. The first project was for Airbus, then came other projects dealing with nanocomposites, including some involving international collaboration.

Is working on such a team all about cooperation, or is there an element of rivalry as well?

Each of us deals with a different project. Sometimes they are totally different, whereas sometimes the differences between them may seem minor but are in fact important, because there are so many variables. And none of us is able to operate all the instruments used in research. Each of us handles several of them and we have to help one another out. Without that there would be no research. Cooperation is crucial.

What does your work look like in practice? You start with nanotubes...?

I do not produce nanotubes. We buy them, add them to polymers and mix them in. That may seem simple, but the biggest problem when preparing nanocomposites is obtaining a homogeneous dispersion, because nanotubes tend to agglomerate together. It makes no sense to add an ingredient on the nano-scale if the result is going to end up being a micro-scale filler. That is why effective mixing is a problem. Nanotubes are in the form of a powder. I add it into the resin, then preliminarily mix it with a stirrer or glass rod. Then several mixing methods can be used: mechanically, by ultrasound, or using a three-roll mill. I consider the three-roll to be the best for resins. I first encountered the method while on a three-month stay in Montreal. I learned a lot there. After returning I showed the results and we tested the samples – because of course I had taken the opportunity to make more of them in Canada, as we did not then have such equipment. As a result, some time later we bought a three-roll mill which we have used on successive projects.

How can you tell which mixing method is better?

We use a high-resolution scanning microscope to see individual nanotubes and how they are arranged. In practice, therefore, that means sitting in front of a computer monitor.

What advice would you give to someone who wanted to do research whose results will translate directly into applications? What should one focus on?

I think that you need to find a good topic and dedicate yourself to pursuing it. If you do something with passion, everything else will come with time.

Universities of technology are traditionally said to be a male domain, do you feel that is the case?

Most of our team consists of women. A large number of my female colleagues are working on their doctorates. There are also a few women in high-ranking positions. But in undergraduate study at the Faculty of Materials Science and Engineering, as I remember, the students were indeed predominantly male.

Do you find time for other interests, apart from science?

Scientific work is of course a big challenge, but I do manage to combine it with other activities. I really love travelling and also sports. ■

Interview by Agnieszka Pollo and Anna Zawadzka