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Carbon Nanotubes: a blessing or a curse?

Many decision-makers find it difficult to realistically assess the opportunities and risks of carbon nanotubes, or CNTs for short. A white paper by Fraunhofer IPA and other experts provides the necessary background – understandable even for non-experts.

Initially, they were seen almost exclusively as a blessing: carbon nanotubes – tiny tubes made of carbon with a diameter of just a few nanometers. It is estimated that they can withstand a current flow around a thousand times higher than copper wires; their thermal conductivity exceeds that of diamonds, the best naturally occurring heat conductor, many times over. Consequently, these small tubes are predestined for numerous applications: be it in fiber reinforcement, touch screens or artificial muscles. And in batteries, they can increase cycle stability and packing density. However, carbon nanotubes also have disadvantages. Risk researchers repeatedly point out the dangers of breathing in and inhaling the tiny fibers and the toxic effects have been repeatedly demonstrated. The first long-term studies are yet to be published.



Whitepaper "Carbon nanotubes: responsible use and meaningful risk management – CNT in the controlled manufacturing process based on the example of battery production"

Free download at:

<https://www.ipa.fraunhofer.de/CNTWhitepaper2024>

Press communication

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Opportunities and risks of CNT: clearly presented

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So are carbon nanotubes a blessing or a curse? This question is difficult to answer for many decision-makers, as the available publications are usually only comprehensible to specialists. "Information on toxicity, hazard potential and risk assessment must also be understandable for non-experts," emphasizes Ivica Kolaric, head of department at Fraunhofer IPA. Researchers at Fraunhofer IPA have now filled this gap together with various other experts. In their white paper "Carbon nanotubes: responsible use and sensible risk management – CNT in the controlled manufacturing process using the example of battery production", they shed light on the potential of nanotubes as well as the critical aspects.

"Whether the opportunities outweigh the risks depends on both the production conditions and the subsequent use," summarizes Kolaric. "In round-the-clock productions that involve only a few process steps and can be easily automated, the risk is acceptable and the use of nanotubes can definitely be worthwhile." Take batteries, for example: As today's batteries already contain materials such as cobalt and nickel, which are significantly more dangerous than carbon nanotubes, the acute hazard potential from CNTs is similar or even lower than with the materials already in use. However, the situation is different for children's toys – where the risk of contact with humans predominates – and for multi-variant productions, where automation would be difficult and the cost of safety precautions would be far too high. The researchers' main focus in the white paper is on pragmatic solutions for the use of CNTs: on the one hand, occupational safety is an absolute must and on the other, it is becoming increasingly important for Europe not to lose touch with Asian markets when it comes to energy storage.

Individual consulting services by experts

The white paper helps decision-makers to classify the opportunities and risks of the high-performance material CNT. If a more in-depth risk assessment is required, the researchers at Fraunhofer IPA are available to provide their expertise and if necessary, refer you to other experts from the white paper's pool of authors who can deal with individual requests in the best possible way.

FRAUNHOFER INSTITUTE FOR MANUFACTURING ENGINEERING AND AUTOMATION IPA

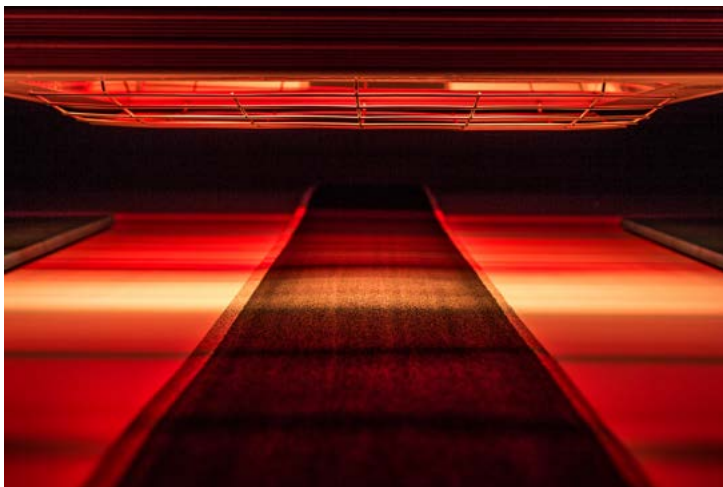


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Safe handling of powders in a glove box.

Source: Fraunhofer IPA/Photo: Rainer Bez



Drying section battery electrode manufacturing.

Source: Fraunhofer IPA/Photo: Rainer Bez

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With nearly 1200 employees, the **Fraunhofer Institute for Manufacturing Engineering and Automation**, Fraunhofer IPA, is one of the largest institutes in the Fraunhofer-Gesellschaft. The total budget amounts to € 82 million. The institute's research focus is on organizational and technological aspects of production. We develop, test and implement not only components, devices and methods, but also entire machines and manufacturing plants. Our 19 departments are coordinated via six business units, which together conduct interdisciplinary work with the following industries: automotive, machinery and equipment industry, electronics and microsystems, energy, medical engineering and biotechnology as well as process industry. The research activities of Fraunhofer IPA aim at the economic production of sustainable and personalized products.