

Tons of used face masks to be turned into energy

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Credit: AI-generated image ([disclaimer](#))

Researchers from the National University of Science and Technology "MISIS" (NUST MISIS), along with colleagues from the U.S. and Mexico, have developed a new technology for producing cost-effective batteries from medical waste.

The authors of the research claim that their technology could turn [waste](#) that is difficult to recycle into raw materials, according to a study published in the *Journal of Energy Storage*.

Researchers say that during the coronavirus pandemic people on the planet started using more than 130 billion [masks](#) every month, which turn into hundreds of tons of polymer waste. When burned it emits toxic gases, so the task of recycling this waste is particularly urgent.

Scientists at NUST MISIS, together with their foreign colleagues, have developed a new technology for producing cost-effective batteries from used masks, where waste drug blister packs are also used as a shell. Thus, [medical waste](#) forms the basis for creating batteries; all that needs to be procured is graphene.

The new technology enables the production of thin, flexible, low-cost batteries that are also disposable, due to their low cost. They are superior in several ways to heavier, metal-coated conventional batteries, which require more manufacturing costs. The new batteries can be used in household appliances from clocks to lamps.

"To create a battery of the supercapacitor type, the following algorithm is used: first the masks are disinfected with ultrasound, then dipped in 'ink' made of graphene, which saturates the mask. Then the material is pressed under pressure and heated to 140 degrees Celsius (conventional supercapacitor batteries require very high temperatures for pyrolysis-carbonation, up to 1000–1300 degrees Celsius, while the new technology reduces [energy consumption](#) by a factor of 10). A separator (also made of mask material) with insulating properties is then placed between the two electrodes made of the new material. It is saturated with a special electrolyte, and then a protective shell is created from the material of medical blister packs (such as paracetamol)," said Professor Anvar Zakhidov, scientific director of the infrastructure project "High-

Performance, Flexible, Photovoltaic Devices Based in Hybrid Perovskites" at NUST MISIS.

Compared to traditional accumulators, the new batteries have a high density of stored energy and [electrical capacity](#). Previously, pellet batteries created using a similar technology had a capacity of 10 watt-hours per 1 kg, but scientists at NUST MISIS and their foreign colleagues have managed to achieve 98 watt-hours/kg.

When scientists decided to add nanoparticles of inorganic perovskite of CaCo oxide type to the electrodes obtained from the masks, the energy capacity of the batteries further increased (208 watt-hours/kg). They have achieved a high electrical capacity of 1706 farads per gram (This is significantly higher compared to the capacity of the best-carbonized electrodes without the addition of graphene (1000 farads per gram).

Scientists have tried before to use various porous natural materials and waste products to make electrodes for supercapacitors. These included coconut shells, rice husks, and recently even newspaper waste, car tire waste, and others. However, working with these materials always required high-temperature annealing (charring) in special furnaces. Masks turned out to be an easier and cheaper material to process since graphene saturation is sufficient to give them unique properties.

In the future, the scientific team plans to apply the new technology for the production of batteries for electric cars, solar power stations and other applications.

More information: R. Mendoza et al, Highly efficient textile supercapacitors made with face masks waste and thermoelectric $\text{Ca}_3\text{Co}_4\text{O}_{9-\delta}$ oxide, *Journal of Energy Storage* (2021). [DOI: 10.1016/j.est.2021.103818](https://doi.org/10.1016/j.est.2021.103818)

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