Thermoelectric materials can be much more efficient

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Credit: Eric Brinkhorst

Researchers from the University of Twente's MESA+ research institute have managed to significantly improve the efficiency of a thermoelectric material. Because of their unique qualities, these materials can convert waste heat into electricity. They may eventually be used to, for example, put the heat issued from a factory chimney or car exhaust-pipe to good use. The fundamental research, which has been published in the

scientific journal *Advanced Energy Materials*, shows that the materials can still be much improved.

Thermoelectric materials, i.e. materials that are able to convert heat into electricity, have been around for a while. Because they are still not sufficiently efficient, they are currently mainly used in gadgets, such as boots that use body heat to charge a phone. However, if heat could be more efficiently converted into electricity, this would open up possibilities for a wide range of practical applications. Think of materials that are able to convert the heat emitted from a car exhaust-pipe into electricity for an electric motor, factories that convert waste heat into electricity and pacemakers that are charged with the body heat of their carriers.

Doubling the capacity

Thermoelectric materials have unique qualities which are not very common in natural materials. For instance, their electrical conductivity should be as high as possible, whereas their thermal conductivity as low as possible. Researchers from the University of Twente's MESA+ research institute have managed to greatly improve the efficiency of thin films of the thermoelectric material NaXCoO2. They have managed to double the capacity of thin films of the material by adjusting the fabrication conditions. According to Dr Mark Huijben, one of the researchers involved, the research shows that further improvements can be made. "Although this concerns fundamental research, it goes to show that it is possible to greatly improve the efficiency of the materials by exercising greater control over the fabrication process. By selecting the right substrate and fabrication conditions, we are able to fine-tune the material to a high degree."

The researchers worked with thin films of the material of less than one hundred nanometres thick. Huijben: "The next step is to arrange thin

layers of different materials on top of each other in order to create new and better qualities."

More information: "Enhanced Thermoelectric Power Factor of NaxCoO2 Thin Films by Structural Engineering." Peter Brinks, Bouwe Kuiper, Eric Breckenfeld, Gertjan Koster, Lane W. Martin, Guus Rijnders and Mark Huijben. *Advanced Energy Materials*. Article first published online: 12 FEB 2014 | DOI: 10.1002/aenm.201301927

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