Rattling ions limit heat flow in materials used to reduce carbon emissions, study finds

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A new study published today in the journal *Nature Materials*s has found a way to suppress the thermal conductivity in sodium cobaltate so that it can be used to harvest waste energy.

Led by scientists at Royal Holloway University, the team conducted a series of experiments on crystals of sodium cobaltate grown in the University's Department of Physics. X-ray and neutron scattering experiments were carried out at the European Synchrotron Radiation Facility and in the Institut Laue-Langevin in Grenoble, using the UK's national supercomputer facility HECToR to make their calculations.

They believe their approach can easily be applied to other substances, since they only require tiny crystals and will, therefore, guide the design of the next generation of thermoelectric materials.

"The global target to reduce carbon emissions has brought research into thermoelectric materials centre stage," said Professor Jon Goff from the Department of Physics at Royal Holloway.

"If we can design better thermoelectric materials, we will be able to reduce the energy consumption of cars by converting waste heat in exhausts into electrical power, as well as cooling hot spots on computer chips using solid state refrigerators."

Thermoelectric coolers are also used in air conditioners and in scientific equipment where a rapid response to changes in temperature is required.

Energy harvesting is also important in miniaturised electronic devices, including "systems on a chip", and power recovery using this method is useful for any off-grid electricity applications, including in space.

"The development of thermoelectric oxides offers an environmentally clean alternative to current materials that contain elements that are harmful, such as lead, bismuth or antimony, or those that are in limited supply, such as tellurium," added Professor Goff.

More information: Suppression of thermal conductivity by rattling modes in thermoelectric sodium cobaltate, DOI: 10.1038/nmat3739

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