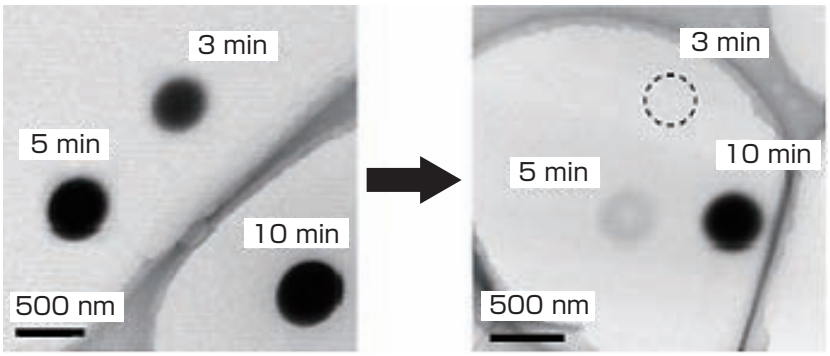
Development of a cleaning system for transmission electron microscope

For nanoscale imaging and chemical analysis with high performance and reliability

We have developed a system for cleaning of transmission electron microscope (TEM) without disassembling the microscope. The system is composed of a plasma generator and a vacuum pump which are operated effectively to produce sufficient amount of oxygen radicals inside a TEM column. The oxygen radicals can chemically etch the hydrocarbon-based contaminations accumlated on the inner wall of the TEM column without damaging the microscope. This system promises us high-resolution imaging and chemical analysis with high quality and reliability.



Dramatic reduction of contamination: before cleaning (left) and after cleaning (right)
Black dots are formed when electron beam is passed through a sample in transmission electron microscope (TEM) before cleaning. After cleaning TEM with the developed cleaning system, no black dots were formed with electron beam irradiation for 3 minutes, and minimal amount was formed with 5 minute irradiation. Black dots appeared with 10 minute projection, but their thickness was reduced to one fifth.

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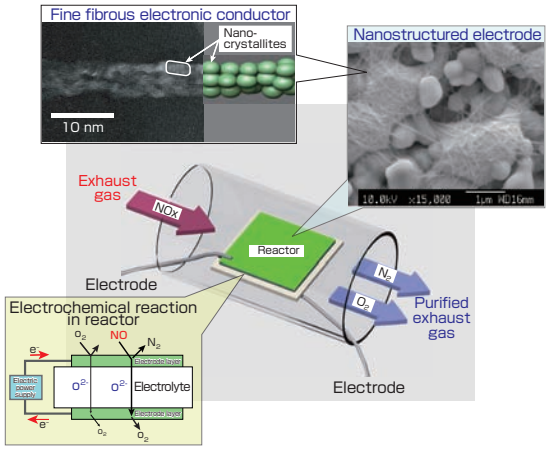
Development of a highly effective electrochemical reactor for decomposition of NO_x

A practical low-temperature operation is achieved

We developed an electrochemical reactor that decomposes and purifies NO_x in diesel engine exhaust gas at a low temperature with high efficiency. Nano-structured catalytic electrodes of the reactor consist of a framework of GDC (Gd doped CeO_2) particles and nano-fibers of an electro-conductive material tangled over the framework. Electro-conductive particles about 3 nm in diameter were self-assembled to form the nano-fibers by an electro-chemical treatment. This electrochemical reactor decomposes NO_x in diesel engine exhaust gas containing high concentrations (about 20 %) of oxygen at a lower temperature than 250 °C, and no reactant is necessary. It also improves the fuel efficiency because of the reduction in energy required to clean exhaust gas. This technology enables the construction of a system that combines air quality conservation with a reduction in CO_2 emission. The reactor will replace current exhaust purification systems for diesel engines.



Schematic diagram of developed electrochemical reactor

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