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Giant Electrostriction in highly defective oxides: The next generation of electromechanical materials.

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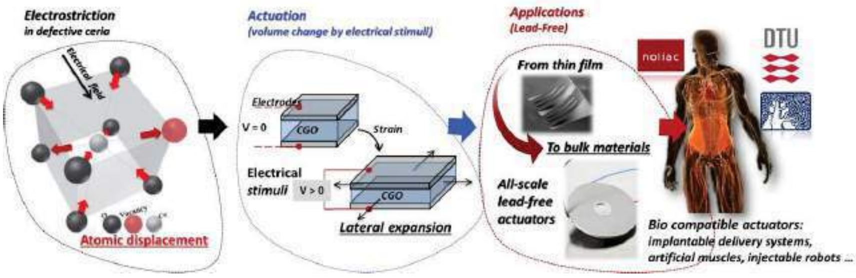
'Smart' materials such as piezoelectric or electrostrictive materials, which change their shape in response to external fields, are deployed in a wide range of sensing and actuating applications, including consumer electronics, robots and automotive systems. For these reasons, Giant Electrostriction effect (Giant-E) in rare earth doped cerium oxide is one of the most fascinating discoveries in materials science in recent years. Scientists at the Weizmann Institute of Science (WIS), partners of this project, reported that thin films of Gd-doped Ceria ($Ce_{1-x}\,Gd_x\,O_{2-\delta}$, CGO), exhibit an exceptionally high electrostrictive response even under moderate electric field. At present, the most widely used electrostrictor materials contain lead (Pb) which is highly toxic and restricted by the European RoHS directive. CGO, in other hand, contains no hazardous elements, opening further possibilities to develop environmental friendly devices, also for biomedical applications.



Despite this great potential, so far only CGO thin films with a specific textured microstructure have been found to be electromechanically active. With this in mind, the scientific aim of the GIANT-E project is to unveil the inner mechanism governing the electrostriction effect in these materials, and extend such property to the bulk form. The technological aim is to stabilize the electrostriction effect in thick samples, for a new paradigm of lead-free electromechanical active materials.