

High temperature materials for energy: they breathe, eat and shake.

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The global mission to promote renewable energy sources is pushing both academia and industry toward novel solutions for energy conversion and storage. Some popular examples are solar cells, wind power and high performing batteries of new generation. Many others advanced and strategic technologies are however brewing in the scientific and high-tech communities and these include low and high temperatures applications.

At the core of all these technologies, there are the so-called functional materials. These possess electrical, thermal, chemical, and mechanical properties which, from their atoms, can generate special functions which, with engineering, become tangible in the large scale. Interestingly, in the energy conversion and storage devices, functional materials work as organs of a living body: they can extract, catch and transform the energy spread in the surrounding, bringing it to our daily use.

In this lecture, we will develop this analogy in a few examples concerning ceramic functional materials. These are special advanced ceramics which activate their functions mainly at high temperatures. They can play basic functions such as “breathing” chemical energy, “eating” other compounds and even “shaking” releasing electro-mechanical energy. As materials scientists, our work is to understand, engineer and optimize these functions, to create efficient energy systems available for the society. Therefore, we will screen some of these materials in the newest discoveries and trends in the field of energy technologies that are inspired by the vision of a 100% clean future.