Eur. Phys. J. Appl. Phys. **98**, E1 (2023)

https://doi.org/10.1051/epjap/2022220292

THE EUROPEAN PHYSICAL JOURNAL
APPLIED PHYSICS

Special Issue on 'Materials for Energy Harvesting, Conversion, Storage, Environmental Engineering and Sustainability', edited by M. El Ganaoui, M. El Jouad, R. Bennacer and J.M. Nunzi

Editorial

Materials for energy harvesting, conversion, storage, environmental engineering and sustainability

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Received: 21 November 2022 / Received in final form: 9 December 2022 / Accepted: 12 December 2022

The world is mathematics, the world is physics. Assertions that we often hear, everyone grasps them with their own level of abstraction. More than ever, these disciplines have shown today that they can project us into the future, change our perception of reality to the point of replacing our senses.

Materials and energy are engraved tablets of the history of mankind and its interaction with the mathematical and physical sciences. Part of this story has been the subject of previous special issues *2016, 2017, 2019, 2020, 2021*.

This is how these disciplines exist today and reward scientists. The scope is noticeable with the societal return and the rapid industrialization that joins the imagination. This is how humans are augmented by the various artificial intelligence interfaces that accompany them everywhere and separating them would almost be equivalent to amputating a member of their body.

The science that has been brewing for centuries and crystallized for a long time is now delivered at an extraordinary speed, upsetting habits, behaviors, and perceptions and this is only the beginning. The digital revolution which is only the translation of an interaction between energy and matter which has endowed humanity with immeasurable computing power at the service of the cook with a robot capable of suggesting chef's dishes or the brain of a seaport or a large-scale industrial facility. This computing power recovered by the reactivity of decision interfaces is at the origin of great human disruption.

Moore's Law has convinced us that the power of a computer doubles every 18 months and already this behavior has contributed to the scenario described above. Now quantum processors will see their power quadruple every 18 months. This means that many problems open today like those of the Clay foundation will find a new chance of solution. Very clever whoever imagines the possibilities resulting from quantum computing power coupled with the booming Artificial Intelligence.

The coupling with energy is still there and will still be as if thermodynamics took up the challenge with mathematics to be timeless and irreplaceable in the face of the disproportionate growth of quantum processors. The computing power could be such that we will have a dual of the real world completely dedicated to the flow of data to guide, simulate, replace natural processes, to anticipate risk-taking, design imaginary functional materials, unexpected chemical reagents, reach the frontiers of physics and therefore of reality: dizzying and maybe perilous. This is made possible more than ever with the 2022 Nobel Prize in Physics awarded to Austrian, French and American researchers for their work on quantum entanglement which is at the basis of quantum communications and computers.

Within this breathtaking background comes this special issue on materials energy harvesting, conversion, storage, environmental engineering, and sustainability. It addresses several theoretical [1,2] and experimental themes such as microfluidics [3], energy recovery and storage [4–13], water and corrosion [14–16], biosensors [17,18] and materials [19–26].

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Cite this article as: Mohamed El Jouad, Mohammed El Ganaoui, Rachid Bennacer, and Jean-Michel Nunzi, Materials for energy harvesting, conversion, storage, environmental engineering and sustainability, Eur. Phys. J. Appl. Phys. **98**, E1 (2023)