

# Added value materials from waste for advanced energy storage devices

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The fabrication of added-value materials for energy storage through recycling of waste favors at the same time circular economy and green transition. Within this context, moving from a robust background in the research on lithium-ion batteries, ELEMNT Lab (ELEctrochemistry, Materials and NanoTechnology Lab) of the Department of Basic and Applied for Engineering at Sapienza University of Rome has been recently focusing on waste micro and nano materials, either from industrial and agricultural sources, for supercapacitors, lithium-ion and beyond lithium energy storage devices. The present communication aims at giving an overview of our activities. The main provided examples concern (i) carbon porous micromaterials and nanomaterials from rice husk, and (ii) hard carbon from exhausted tires. The first proved to be excellent electrode materials for supercapacitors, showing extraordinary lifetime and capacity retention, the latter found employment as electrode materials for both lithium and sodium ion batteries.<sup>1-3</sup> Finally, a brief mention will be given about our most recent results: moving from a previously developed strategy to recover Mn and synthesize different oxides from mining tailings from Brazilian Amazon Rainforest,<sup>4</sup> we are now using the obtainable  $\delta$ -MnOx and  $\alpha$ -MnOx, respectively characterized by a layered and a tunneled structure, for Zn-ion batteries.

## References

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