Plenary [ ] Invited lecture [X] Oral presentation [ ] Poster [ ]

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SILICON NANOMATERIALS: LIFE CYCLE ANALYSIS FOR BEGINNERS

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The convergence of electrochemistry with traditional silicon nano- and microelectronics represents a composite technology enabling innovation in energy harvesting and storage systems and semiconductor-based manufacturing strategies. To expand the catalog of current high-performance nanotechnologies dedicated to electrical energy storage, one can rely on the recycling of used photovoltaic modules, with the aim of generating new sustainable nanomaterials with increased traceability, offering precise control over the life cycle of renewable energy sources and raw materials.

Here we analyse the experimental conditions and the environmental impact for the recovery/recycling of monocrystalline silicon photovoltaic panels - beyond Europe - to enable greener manufacturing of silicon nanostructures and "reclaimed" silicon wafers to build micro-supercapacitors. Indeed, silicon-based materials and their derivatives have attracted considerable attention as electrode materials in supercapacitors and hybrid supercapacitor-battery devices with favorable performances due to the facile integration with electronics, non-toxicity and well-established procedures across the entire value chain. For instance, high-voltage micro-supercapacitors based on Si nanostructures require optimized electrolytes to attain higher energy density compared to Li-ion batteries. We'll present our recent efforts towards all-solid state, high-voltage micro-supercapacitors with recycled Si-based nanomaterials for enabling circular economy approaches for smart energy storage systems.

The support of Fonds Européen de développement régional (FEDER) and the Walloon region under the Operational Program "Wallonia-2020.EU" (project CLEARPOWER) is gratefully acknowledged. This work was supported by the Belgian F.R.S. – FNRS under the grants n° T.0106.16, U.N.027.18, and R.8016.21. Funding from the European Commission's Horizon 2020 Research and Innovation Programme under Grant Agreement n°963530 is heartily acknowledged.

Keywords: Silicon, photovoltaics, life cycle analysis, micro-supercapacitors.