# Binder free Mn-V-oxide decorated carbon felt for new generation batteries

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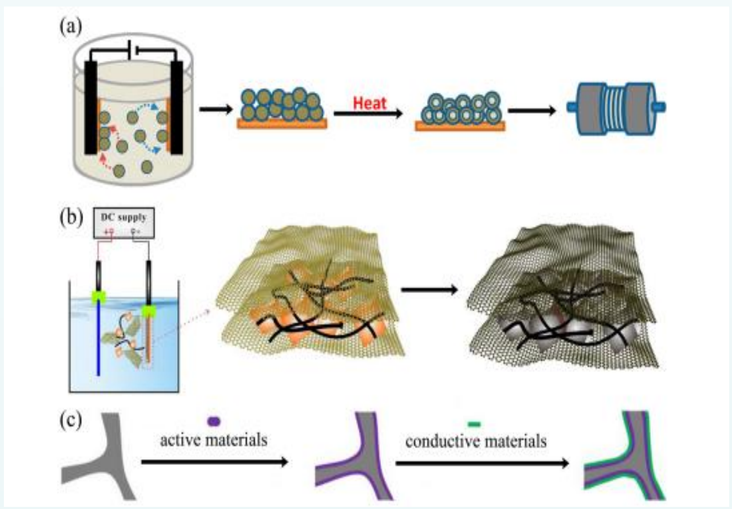
## Introduction

Circular economy is particularly impacting the battery future market because of the necessary reuse of precious materials involved. Independently from the strategy of recycling or reusing , it will be almost clear that in the next ten years about 100 GWh of lithium batteries will be recycled. For the new generation of batteries a better design and fabrication of cells having fast and cheap recycling processing, conjugated to safer devices for everyday operations are urgent to be implemented.

## Binder Free Electrodes




Are possible solution for

(1) the weak interaction and interface problem between the binder and the active material (metal oxide, Si, Li, S, etc.)

(2) large volume change,

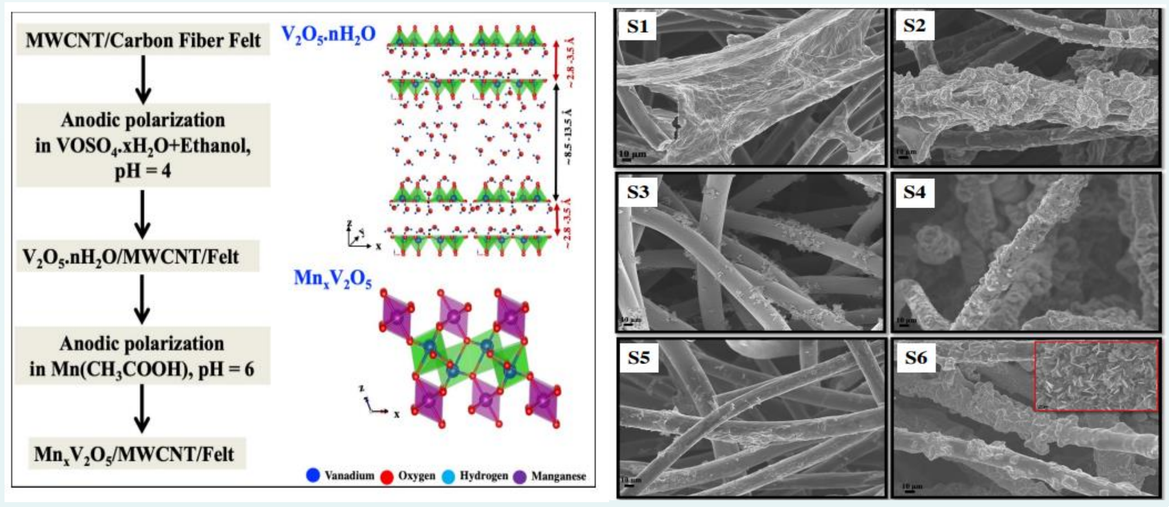
(3) low ion/electron conductivity

(4) self-aggregation of active materials during charge and discharge processes

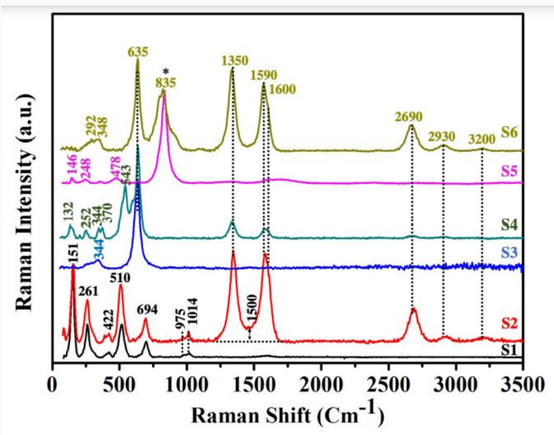
(5) Poor specific capacitance

(6) Recycling bottlenecks

## Mn-V-Oxide

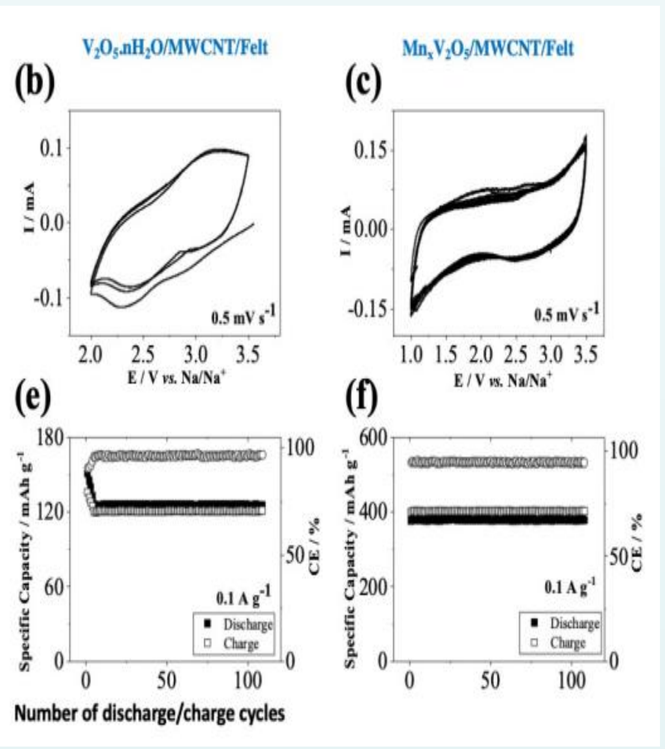



Significant nanostructuring properties of MnV oxides on MWCNT functionalized carbon fibers allows the fabrication of binder free batteries by electrodeposition. Mn doping into V2O5.nH2O/MWCNT produces an amorphous MnxV2O5/MWCNT with high surface to volume ratio, higher active The electrodeposition avoids the use of binder ( glues and other additives) making the battery 100% recycleable.




Above the Raman spectra of the MnVO oxide ( top curve ) show the chemical interaction of the two separated oxides features that is not simply a linear combination demonstrating the formation of a novel active material

## Charge/discharge Na+




MnxV2O5/MWCNT without hydration. provides a remarkable Na+ reversible specific capacity of 400 mAh/g and 224 mAh/g between 3.5 - 1.0 V and 3.5 - 1.5 V range, respectively while the V2O5.nH2O/MWCNT/felt provides only 120 mAh/g between the smaller cut-off potential limits. The MnxV2O5/MWCNT nanostructures synthesis onto fibers of graphitic felt does not present fading capacity during the polarization of 100 discharge/charge cycles.

## Conclusions

The traditional manufacture process contains electrochemically inactive binders and conductive materials, which reduces the specific capacity and energy density of the active materials. When the binder and the conductive material are eliminated, the energy density of the battery can be largely improved. Here conductive carbon substrates are introduced, which serve as carriers for the active materials. It is followed by the binderfree electrode fabrication method from the electrodeposition of new active intermediate oxides showing amazing non fading capacities.

## Bibliography

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