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Na₃V₂(PO₄)₃-Supported Electrospun Carbon Nanofiber Nonwoven Fabric as Self-Standing Na-Ion Cell Cathode

Original

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Supporting Information

Na₃V₂(PO₄)₃-Supported Electrospun Carbon Nanofiber Nonwoven Fabric as Self-Standing Na-Ion Cell Cathode

G. Meligrana,* S. Ferrari, L. Lucherini, J. Celè, F. Colò, J. Brugger, C. Ricciardi, R. Ruffo, and C. Gerbaldi*An invited contribution to a Special Collection dedicated to Giornate dell'Elettrochimica Italiana 2019 (GEI2019)

SUPPLEMENTARY MATERIAL

Na₃V₂(PO₄)₃–supported Electrospun Carbon Nanofiber Nonwoven Fabric as Self-Standing Na-ion Cell Cathode

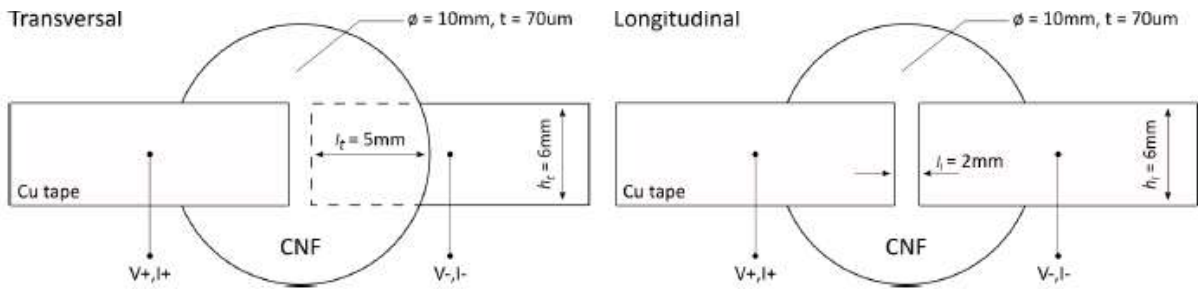
G. Meligrana,^{[a]} S. Ferrari,^[b] L. Lucherini,^[c,d] J. Celè,^[c,d] F. Colò,^[a] J. Brugger,^[d] C. Ricciardi,^[c] R. Ruffo,^[e] and C. Gerbaldi^{*[a]}*

- [a] Dr. G. Meligrana, Dr. F. Colò, Prof. Dr. C. Gerbaldi
Group for Applied Materials and Electrochemistry (GAME Lab), Department of Applied Science and Technology (DISAT), Politecnico di Torino, Corso Duca degli Abruzzi 24, 10129, Torino, Italy
E-mail: giuseppina.meligrana@polito.it; claudio.gerbaldi@polito.it
- [b] Dr. S. Ferrari
Department of Pharmacy, University of Chieti–Pescara “G. d’Annunzio”, Via dei Vestini 31, 66100, Chieti, Italy
- [c] Prof. Dr. C. Ricciardi
Department of Applied Science and Technology (DISAT), Politecnico di Torino, Corso Duca degli Abruzzi 24, 10129, Torino, Italy
- [d] Prof. Dr. J. Brugger
Microsystems Laboratory, École Polytechnique Fédérale de Lausanne - EPFL, 1015, Lausanne, Switzerland
- [e] Prof. Dr. Riccardo Ruffo
Department of Materials Science, Università di Milano-Bicocca, Via Roberto Cozzi, 55, 20125, Milano, Italy

Conductivity measurements

The conductivity of CNF through and along the mat plane (σ_t ; σ_l , transversal and longitudinal, respectively) was evaluated. Two probes measurement was used to measure transversal and longitudinal resistance (R_t ; R_l). A schematic of the two setups used and relevant quantities are shown below. Mat thickness (t) was measured from SEM image and was 70 μm . CNF were punched in 10 mm disks. Contacts to the CNF were made with copper tape (resistance $< 0.01\Omega$) mounted on glass slide. A second glass slide was used to apply uniform pressure on top of the CNF. Current was swept from -1 to 1 mA with a step of 10 mA (Keithley 2400 SourceMeter; Keithley 2000 Multimeter for voltage measurement). Data were acquired with a LabView software already available in the laboratory. Transversal and longitudinal resistance were extracted from the linear fit of V versus I and σ_t , σ_l , computed as:

$$\sigma_t = \frac{t}{R_t h_t l_t} \quad \sigma_l = \frac{l_l}{R_l h_l t}$$



Scheme 1: Setup for the measurement of transversal and longitudinal resistance of CNF samples. Quantities reported were used to evaluate σ_t ; σ_l

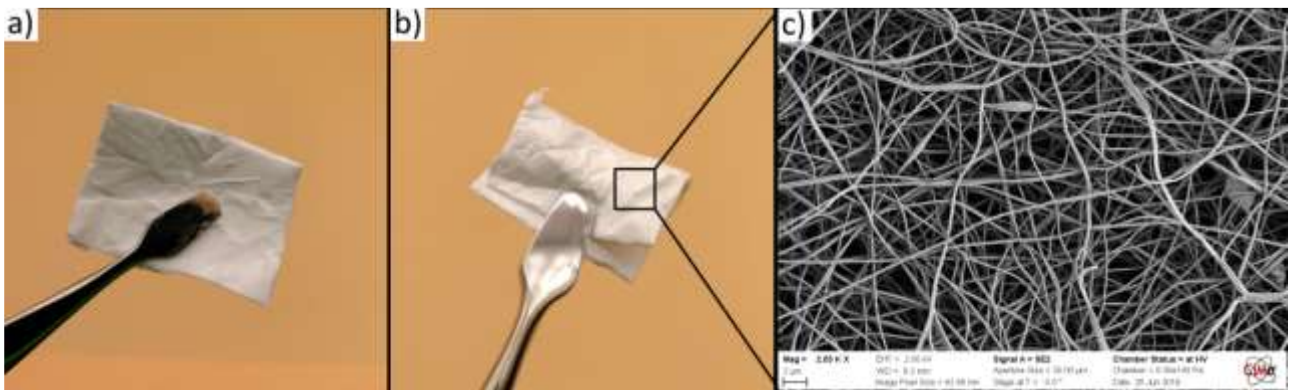


Figure SI-1: a) PAN mat produced by electrospinning and the cut. b) Bended PAN mat showing high flexibility. c) SEM image of mat surface, showing PAN fibers randomly oriented, arranged in a non-woven structure.

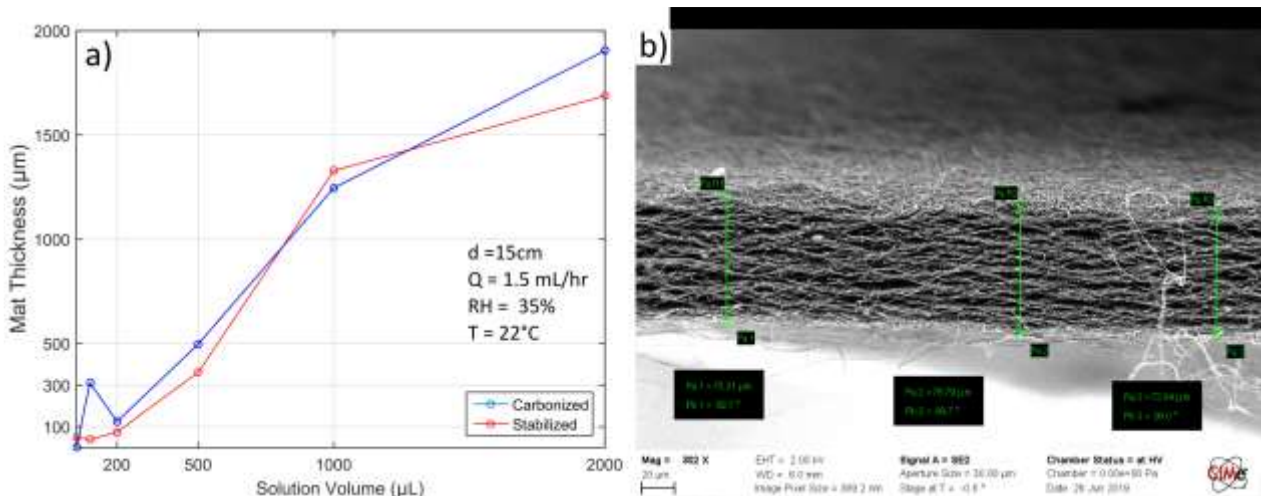


Figure SI-2: a) Dependence of mat thickness on volume of spun solution for stabilized and carbonized fibers, b) example of SEM image used to measure the thickness of a stabilized sample.

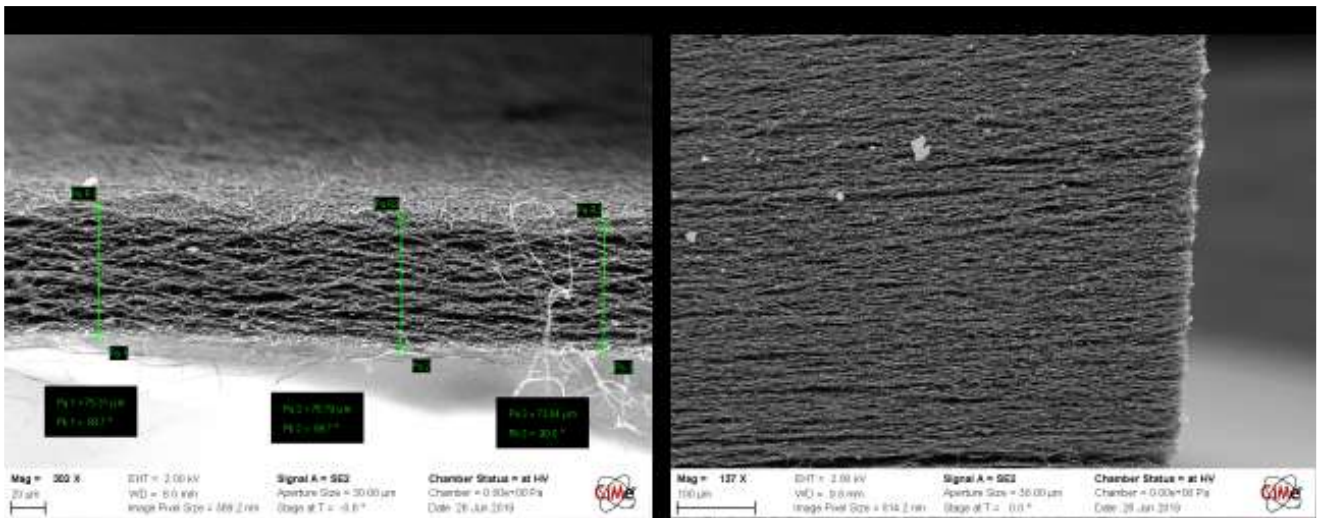


Figure SI-3-SEM cross sections of stabilized mat spun with 200 and 2000 μL . No major morphological differences are visible along the mat section.

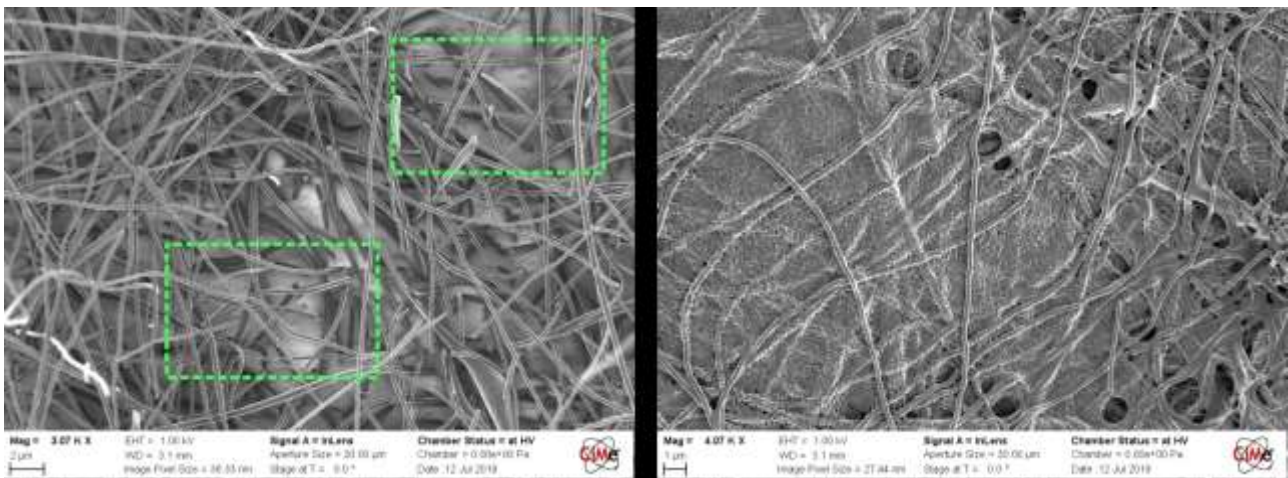


Figure SI-4: Effect of incomplete stabilization on CNF morphology. Green insets highlight melted PAN background.

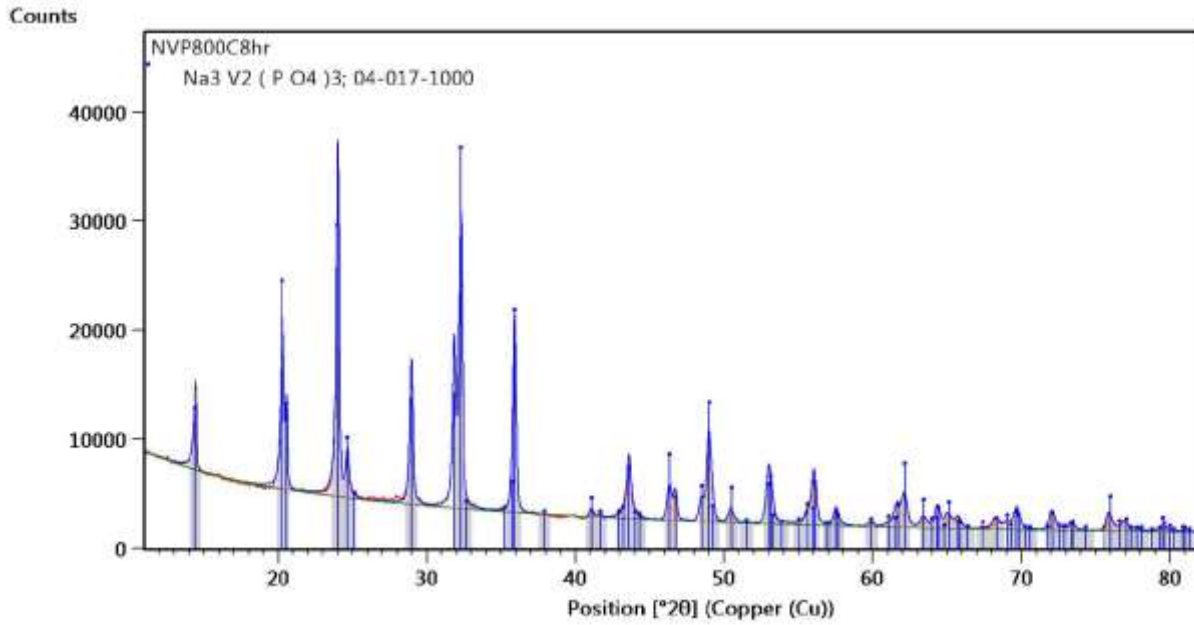


Figure SI-5- Diffractogram of the annealed NVP (800 °C, 8 hrs) with the bars of reflection of the rhombohedral structure.

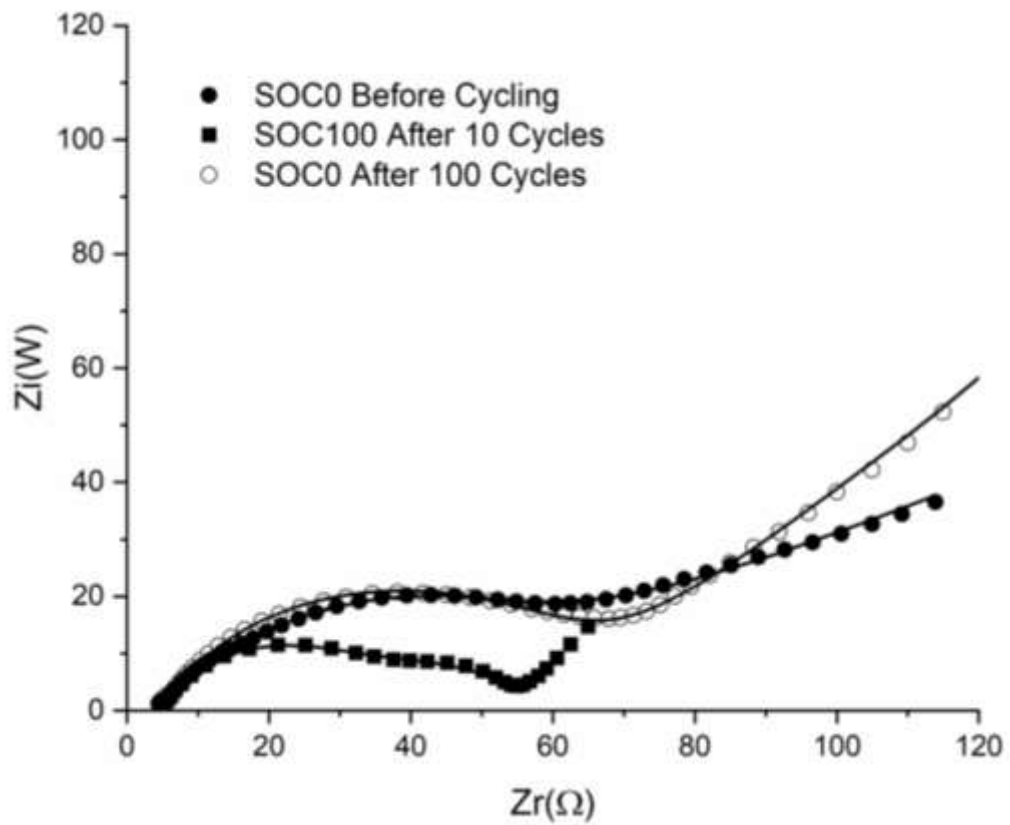


Figure SI-6 – Fitting of EIS spectra by using the equivalent circuit specified in the article.

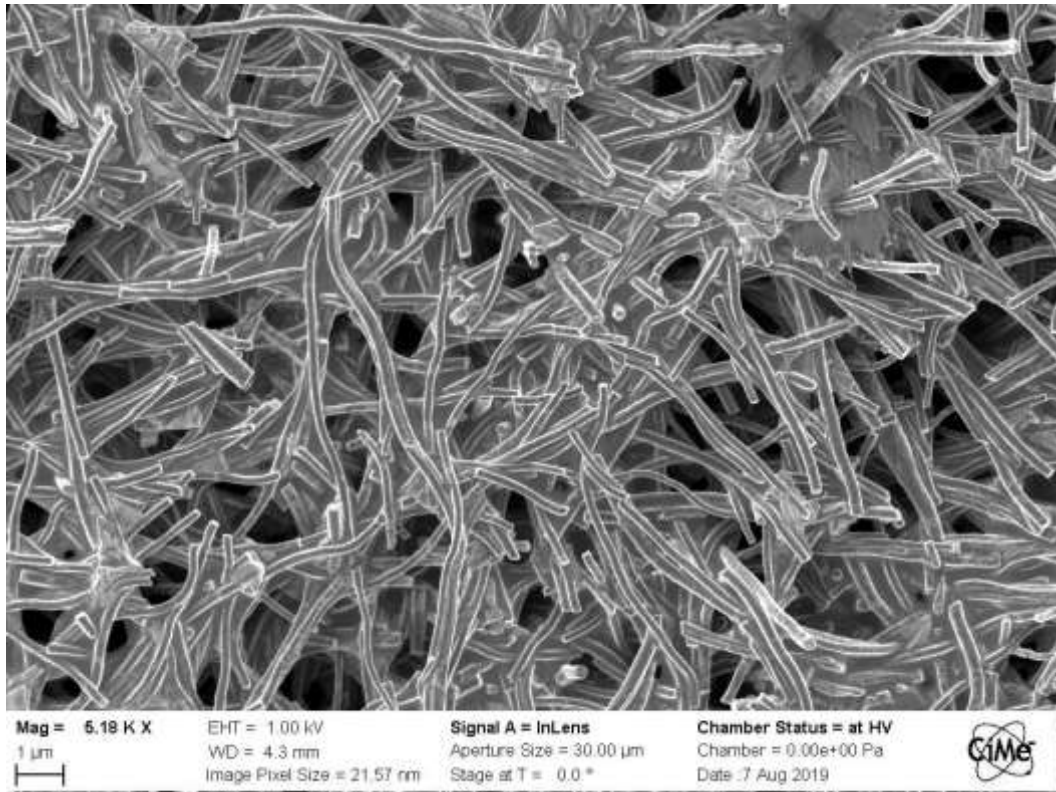


Figure SI-7- Post-mortem SEM of the CNF/NVP electrode. The SEI can be appreciated as occlusion of the pores.

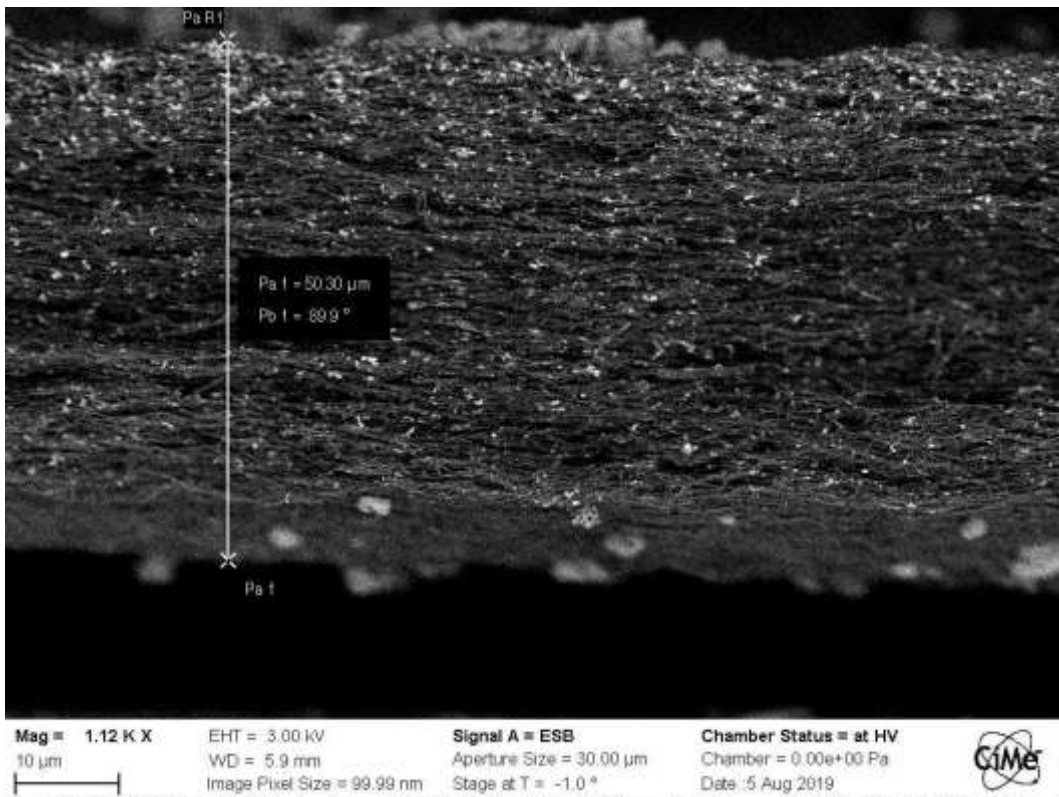


Figure SI-8- SEM (secondary electrons) image of the CNF/NVP electrode produced by Buchner filtration. The thickness (50 μm) is reported.

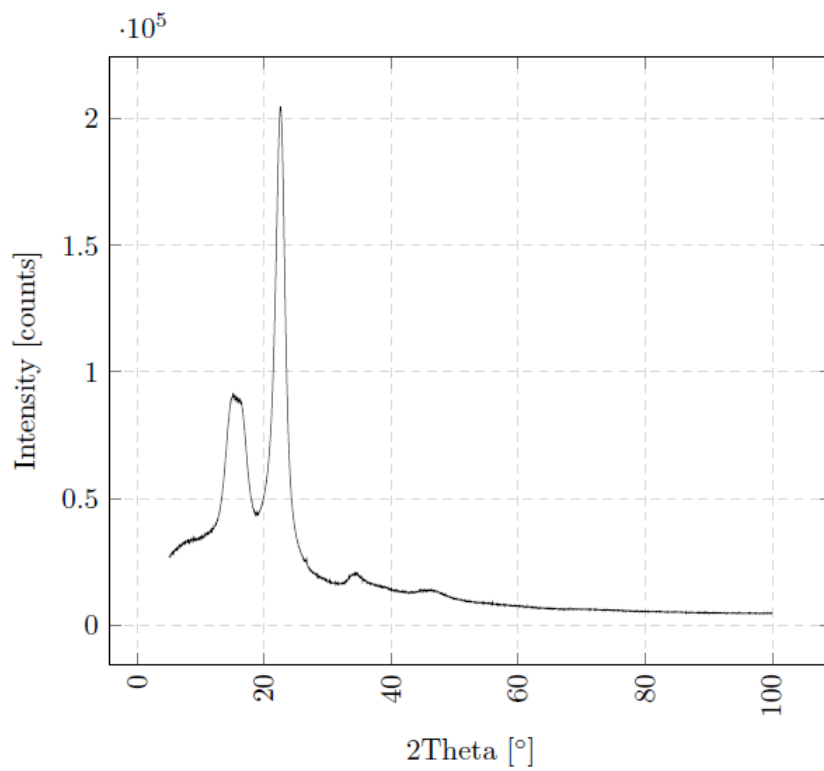


Figure SI-9 – XRD pattern of the CNF/NVP sample obtained by Buchner filtration treated at 800 °C for 2 hours.