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P-type transition metal carbodiimides

MNCN (M = Ni, Mn)

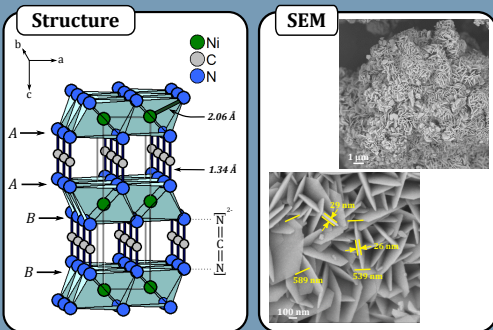
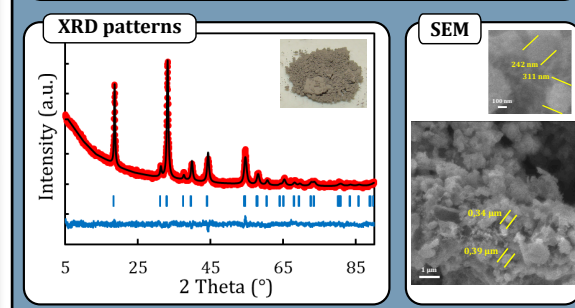
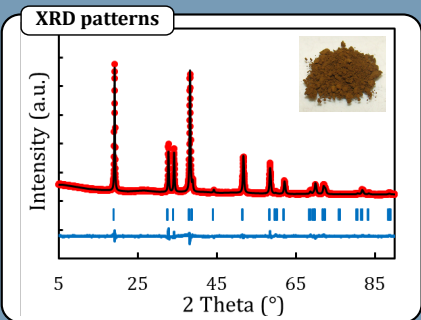
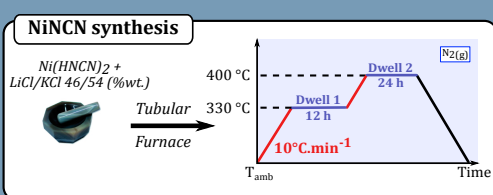
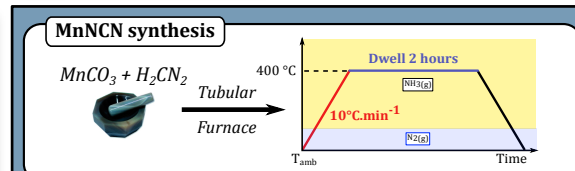
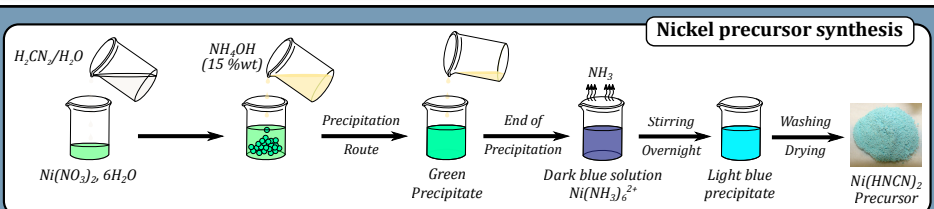
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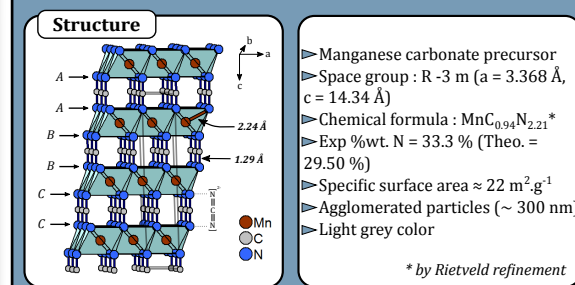
Over the last decade, p-type semiconductors (SC) have known a renewed interest. Indeed these materials may have potential applications for light-emitting diodes, transistors, solar cells, etc. Since the stabilization of the first p-type semi-conductor CuAlO_2 with a delafossite structure type ($\text{A}^+\text{B}^{3+}\text{O}_2$) by H. Kawazoe in 1997 [1], many p-type semiconductors with the same structure have been reported such as CuGaO_2 , CuCrO_2 , CuScO_2 ... Recently, X. Liu *et al.* have reported the synthesis and the structure determination of a new family of materials: the transition metal carbodiimides MNCN (with $\text{M} = \text{Mn} \rightarrow \text{Cu}$) [2,3]. These materials adopt a structure type related to the delafossite, formed by a divalent transition metal and NCN^{2-} anion. We report here the synthesis and the microstructural characterization of two transition metal carbodiimides MnNCN and NiNCN . Impedance measurements demonstrate the p-type conductivity of these materials.

Nickel carbodiimide (NiNCN)

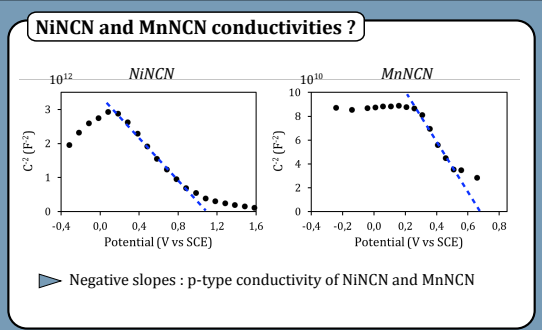
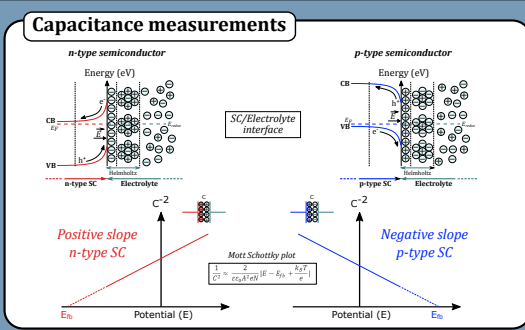
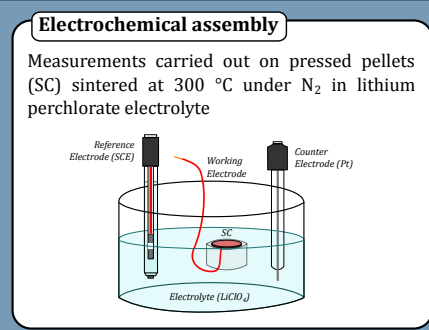
Manganese carbodiimide (MnNCN)



- ▶ Nickel hydrogencyanamide precursor
 - ▶ Space group $\text{P6}_3/\text{mmc}$ ($a = 3.1547 \text{ \AA}$, $c = 9.261 \text{ \AA}$)
 - ▶ Chemical formula $\text{NiC}_{1.15}\text{N}_{2.09}$ *
 - ▶ Exp %wt. N = 29.1 % (Theo. = 28.37 %)
 - ▶ Specific surface area $\approx 75 \text{ m}^2 \cdot \text{g}^{-1}$
 - ▶ Platelets $\sim 600 \text{ nm} \times 30 \text{ nm}$
 - ▶ Light brown color
- * by Rietveld refinement



p-type characterization



References