



Catalytic properties of carbon nanomaterials in hydrogenation reactions by molecular hydrogen

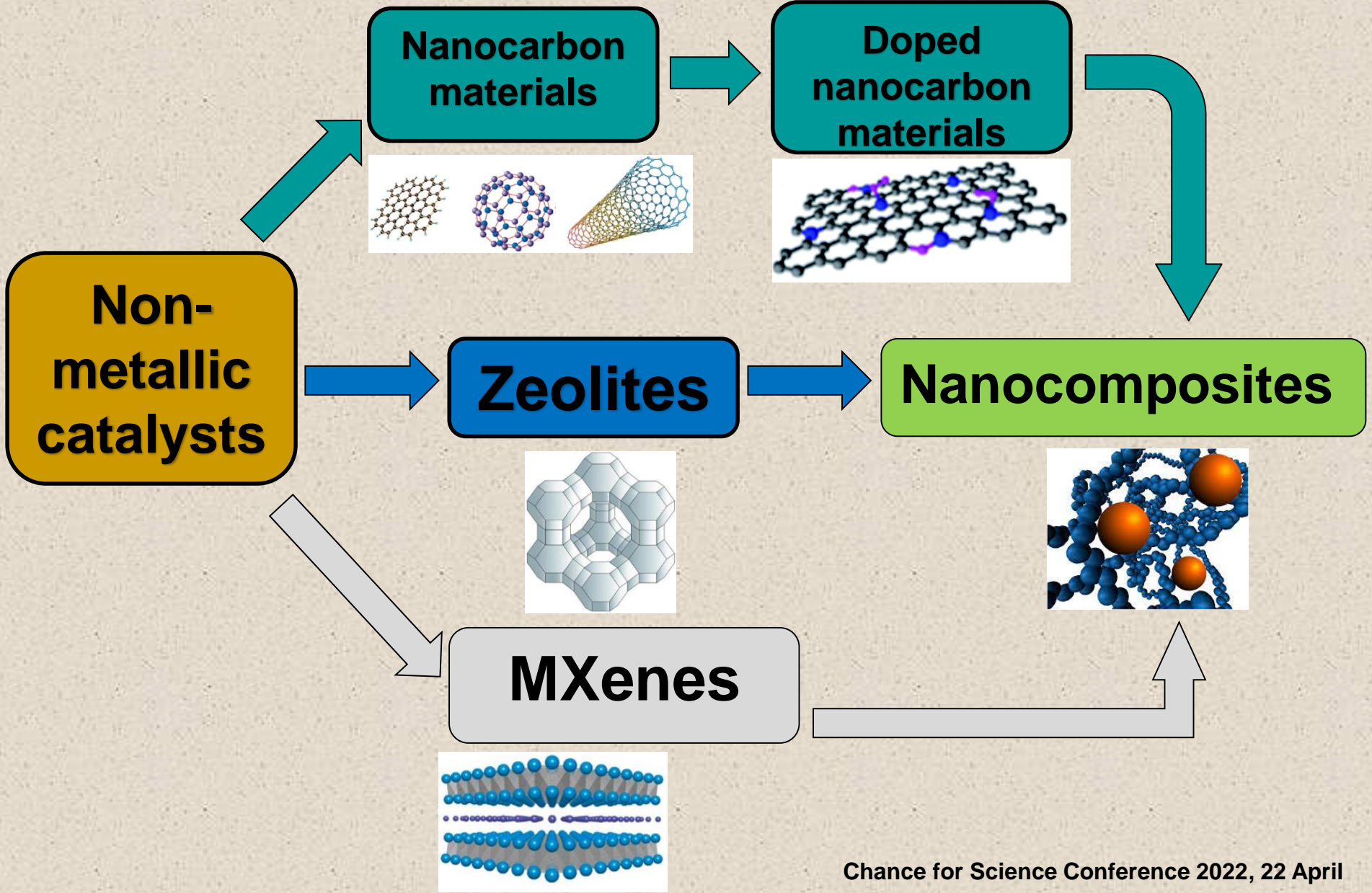
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Current trends in the replacement of metal-based catalysts



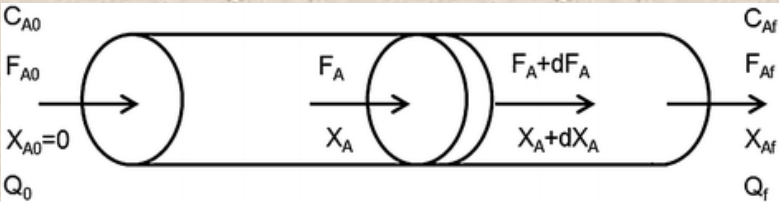
Experimental conditions

Gas phase:

Flow reactor

Atmospheric pressure

Sample activation : 2h in H₂(99,9999%) at 400 °C



Liquid phase:

Batch reactor

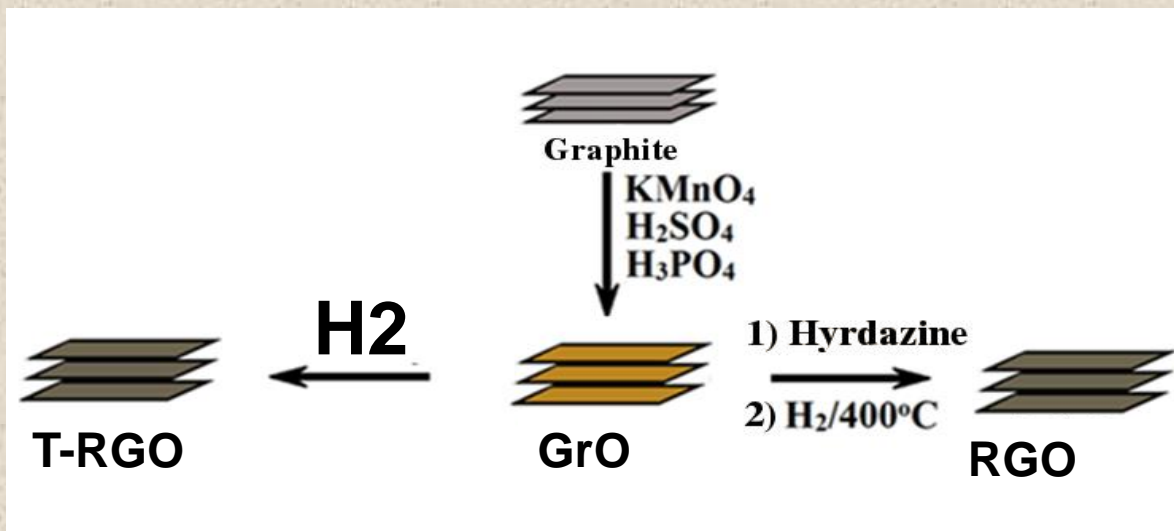
Stirring

H₂ Pressure 10-200 bar

Solvents: hexane, tetrahydrofuran



Obtaining of Reduced graphene oxide and Multi-walled carbon nanotubes



MWCNT

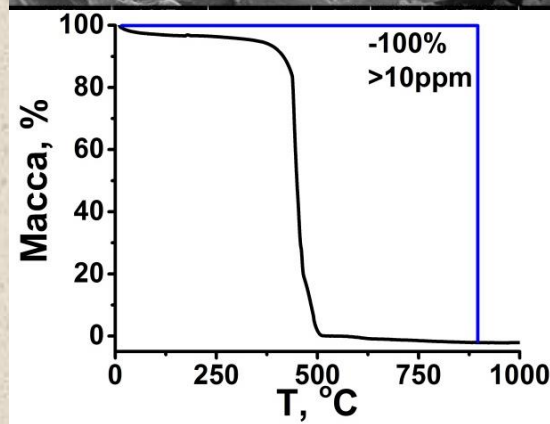
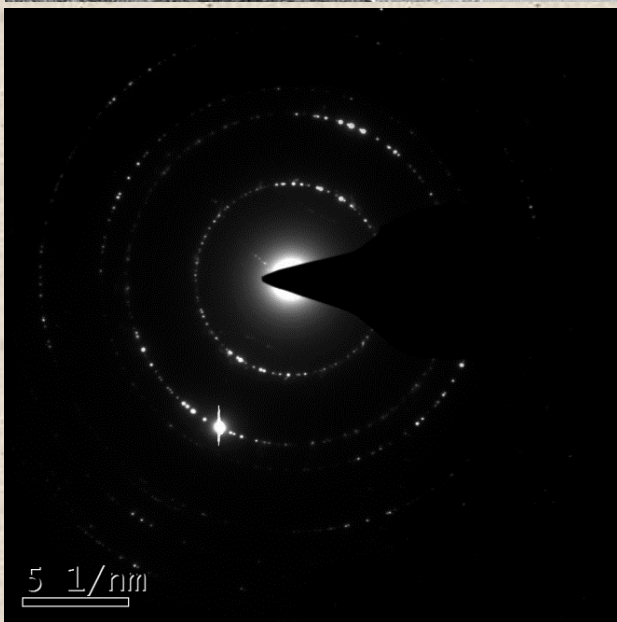
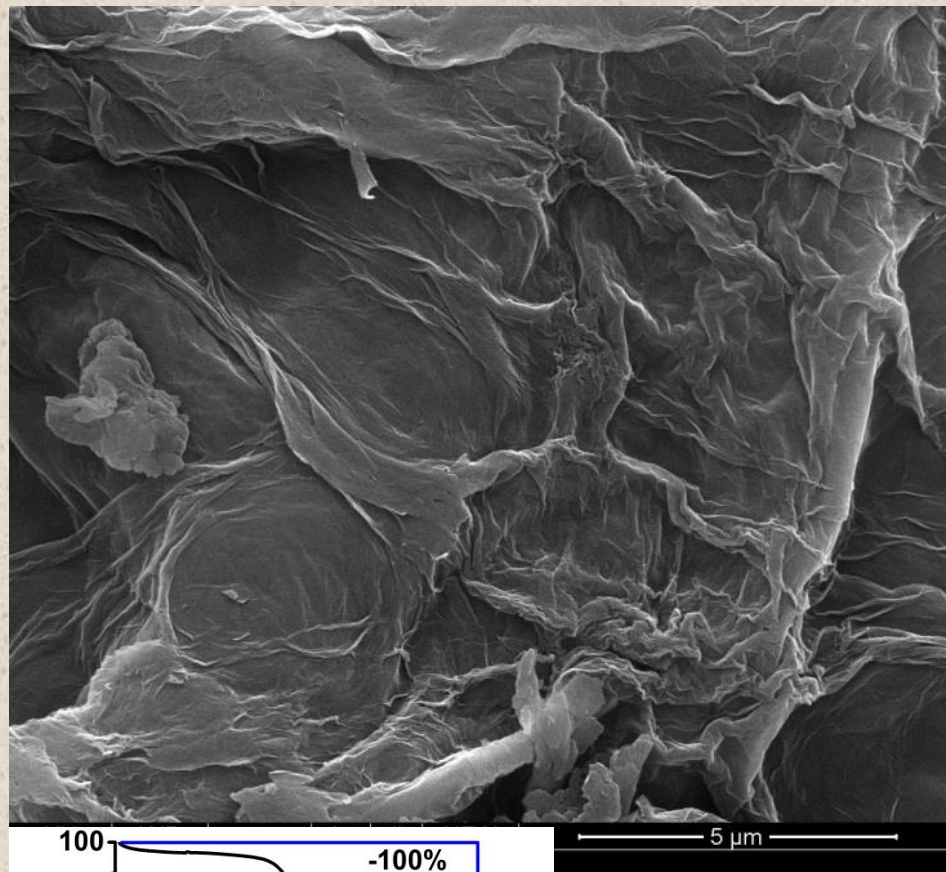
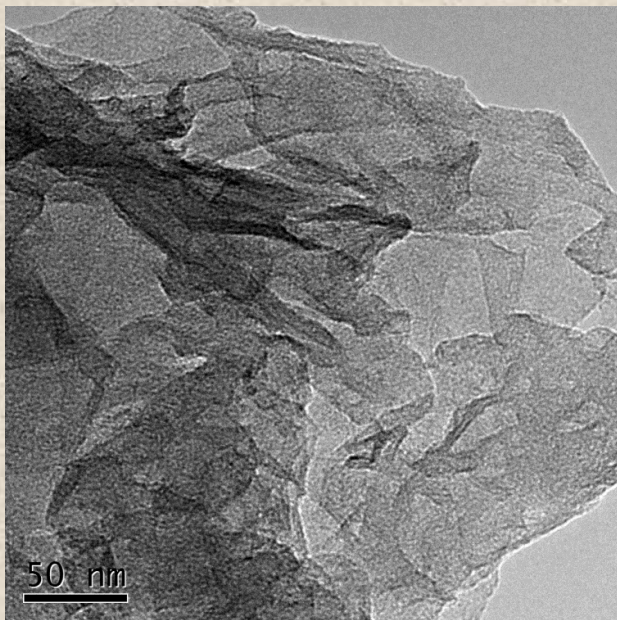
Carbon source	Ethylene
Catalyst	Ni/CaO; Ni/MgO; Co-Mo/MgO;

Method: CVD (chemical vapor deposition)

Purification:

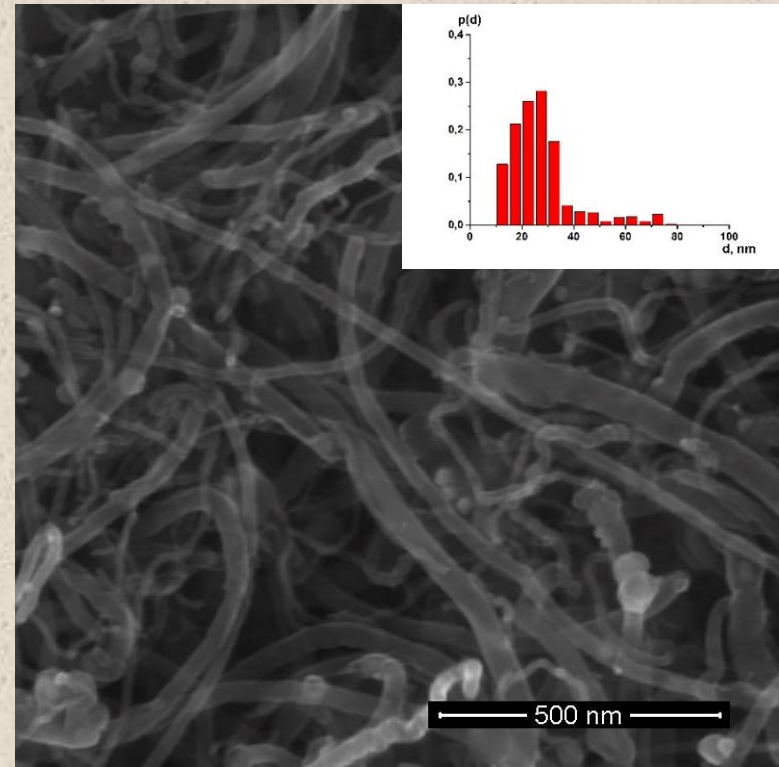
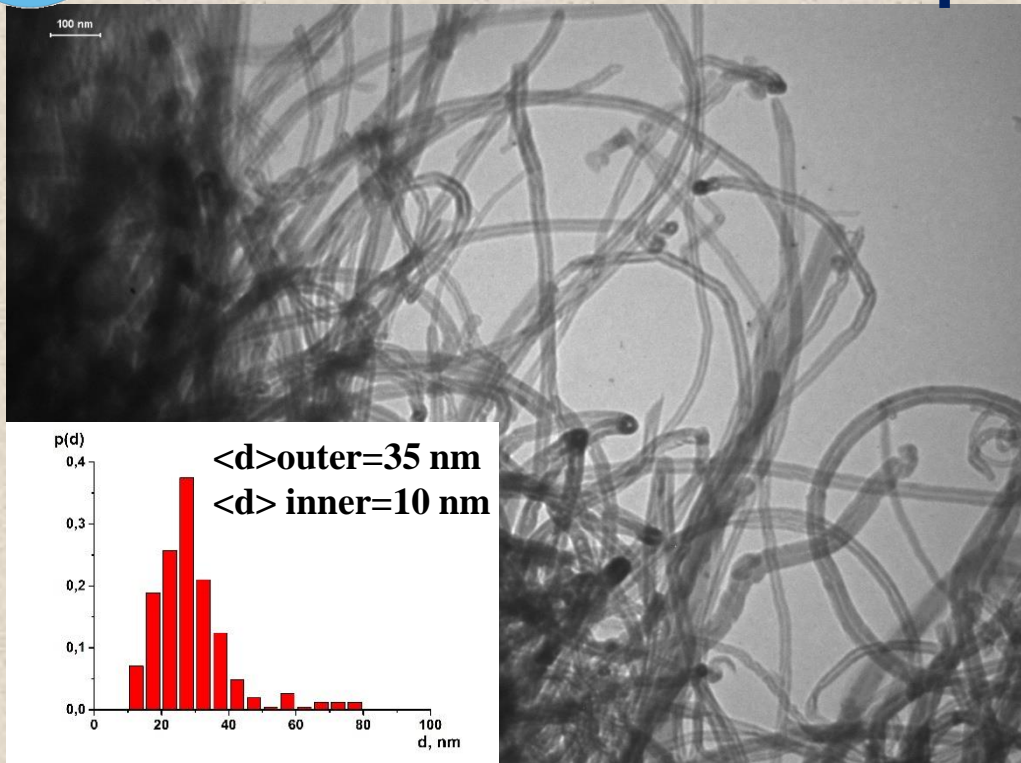
The MWCNT were purified by reflux in the 70% HNO_3 solution for 1 hour, after synthesis, MWCNT were filtered on a glass filter and washed with water, followed by drying at 160°C .

Morphology of RGO





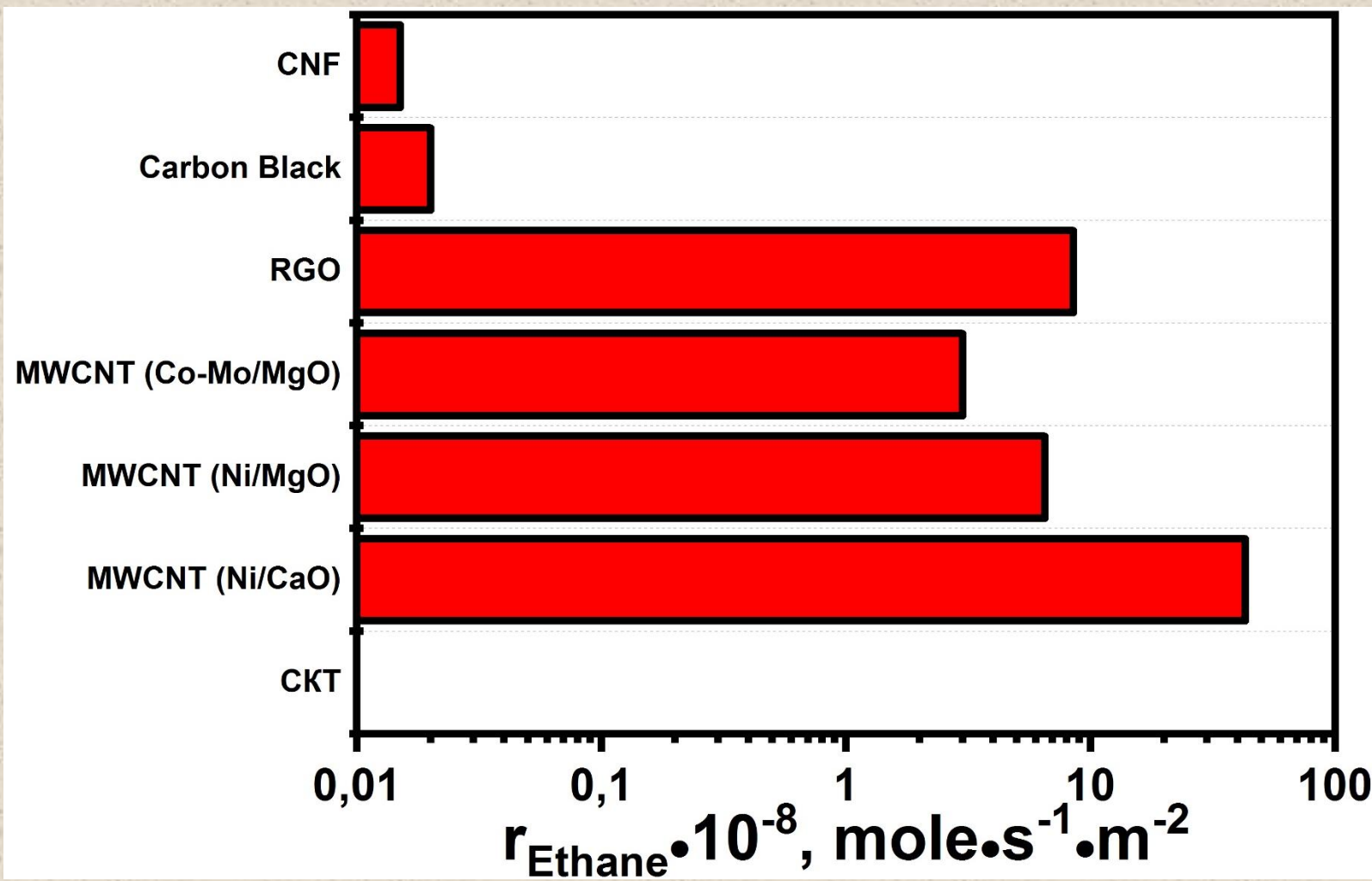
MWCNT morphology Nitrogen adsorption-desorption



Sample	$S_{\text{BET}}, \text{ m}^2/\text{g}$	Micropores volume, sm^3/g	Total pores volume, sm^3/g
MWCNT	150	0,009	0,53



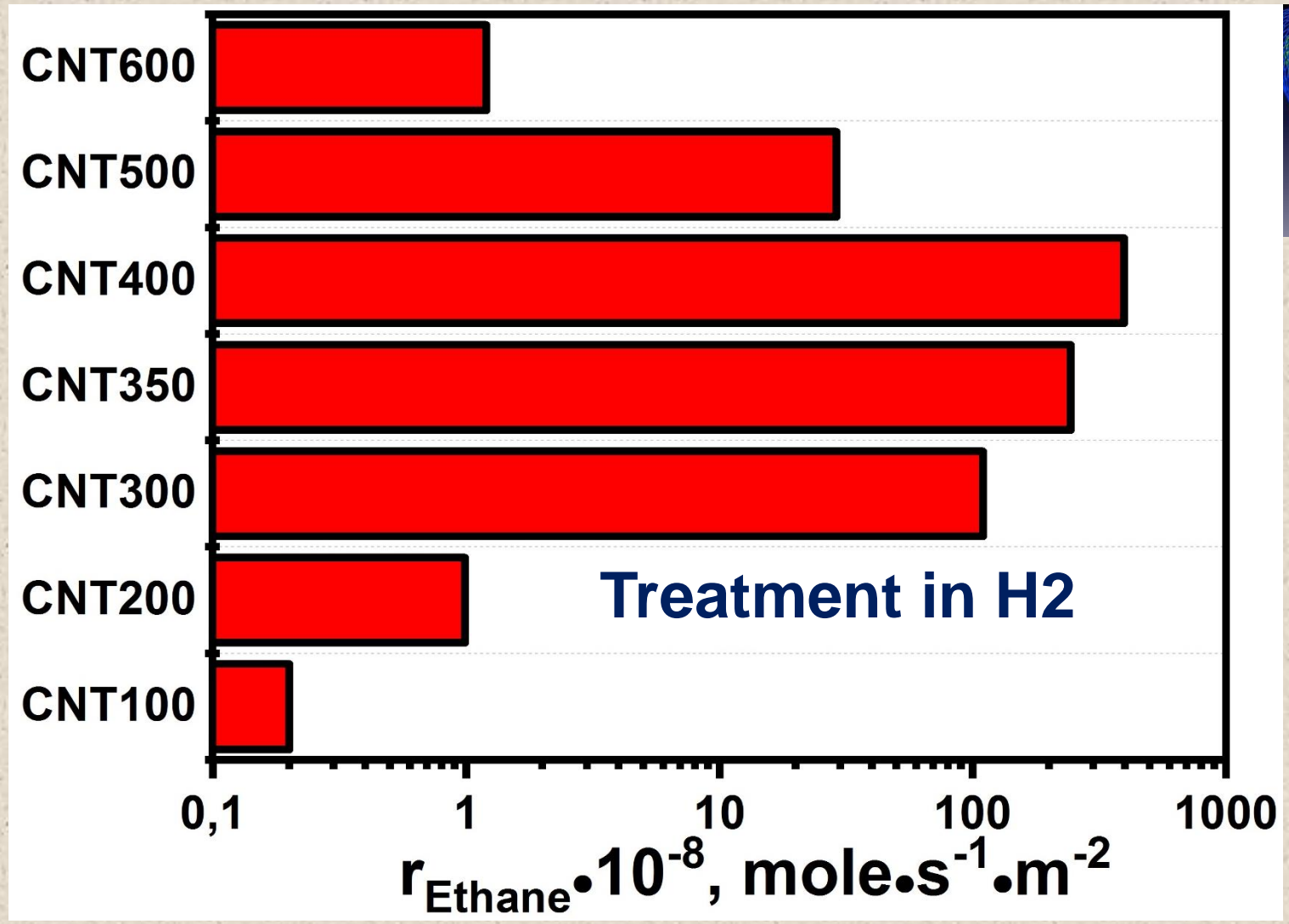
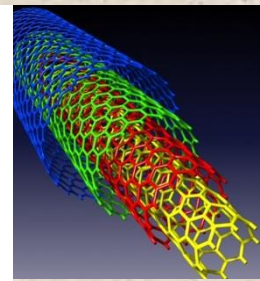
Influence of the structure of nanocarbon materials



Conditions:

$V_{\text{flow rate}} = 50 \text{ml/min}; 90\% \text{H}_2, 10\% \text{C}_2\text{H}_4$

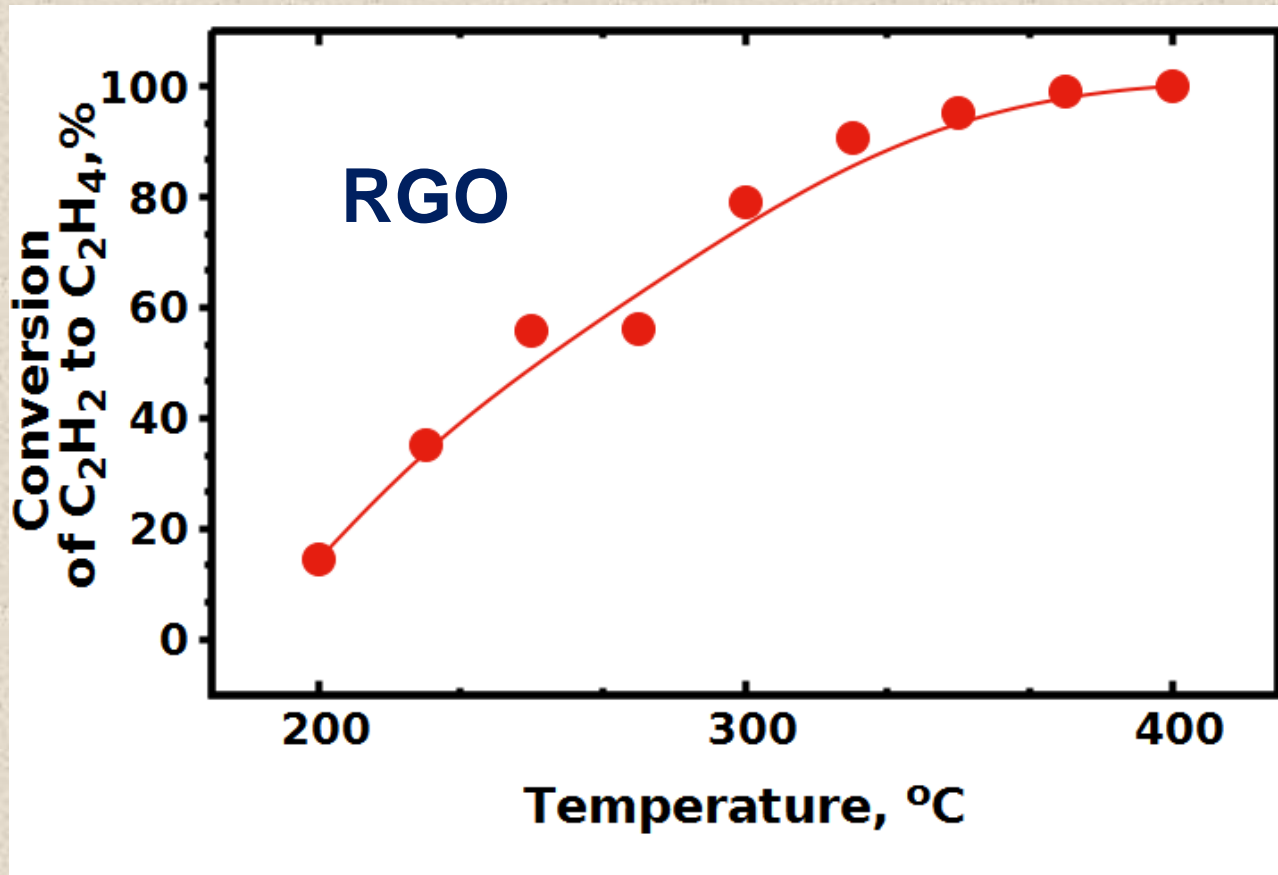
Influence of the activation conditions



Conditions:

$V_{\text{flow rate}} = 50 \text{ml/min}; 90\% \text{H}_2, 10\% \text{C}_2\text{H}_4$

Catalyst of the selective hydrogenation of acetylene



90% C₂H₄

10% C₂H₂



350-400 °C

>99% C₂H₄

<1% C₂H₂

<0,1% C₂H₆

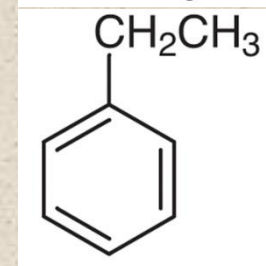
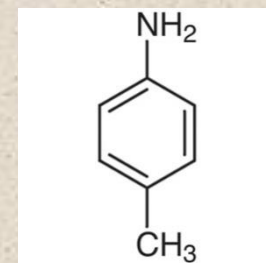
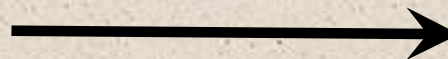
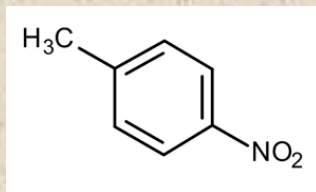
<0,1% CH₄

V_{flow rate} = 50 ml/min

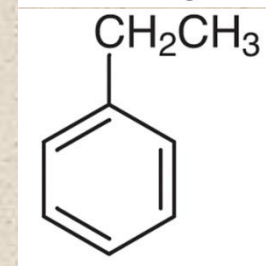
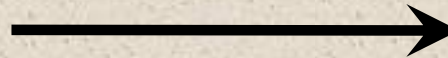
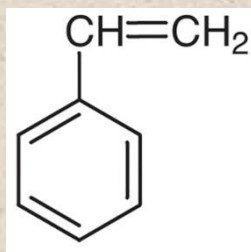
20% H₂ + 2% (1,8% C₂H₄ + 0,2% C₂H₂) + He (balance)

Liquid phase hydrogenation

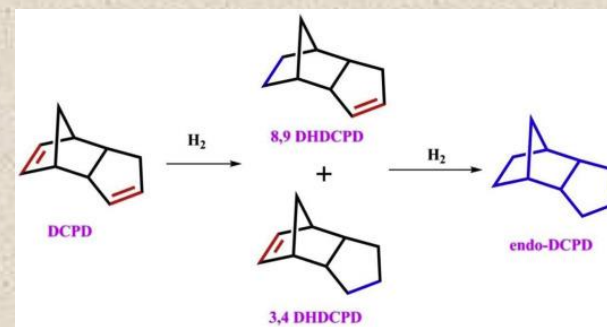
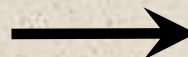
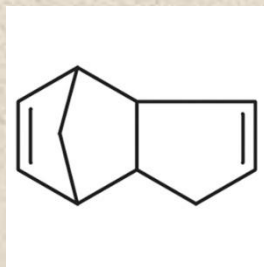
p-Nitrotoluene



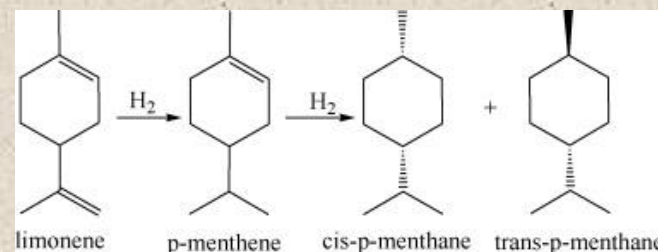
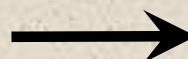
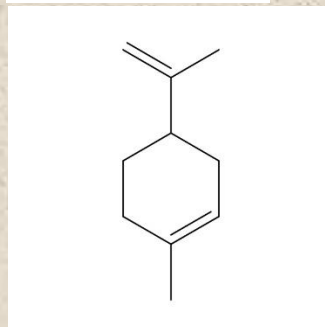
Styrene



Dicyclopentadiene



Limonene



Typical conditions:

T=150 °C; P=40 bar; 24 h

**Thank you for
your attention!**