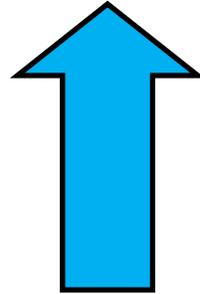
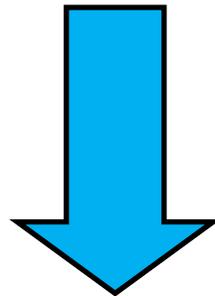


**NATURAIS**

(Proteínas, ADN, Celulose)



**POLÍMEROS**

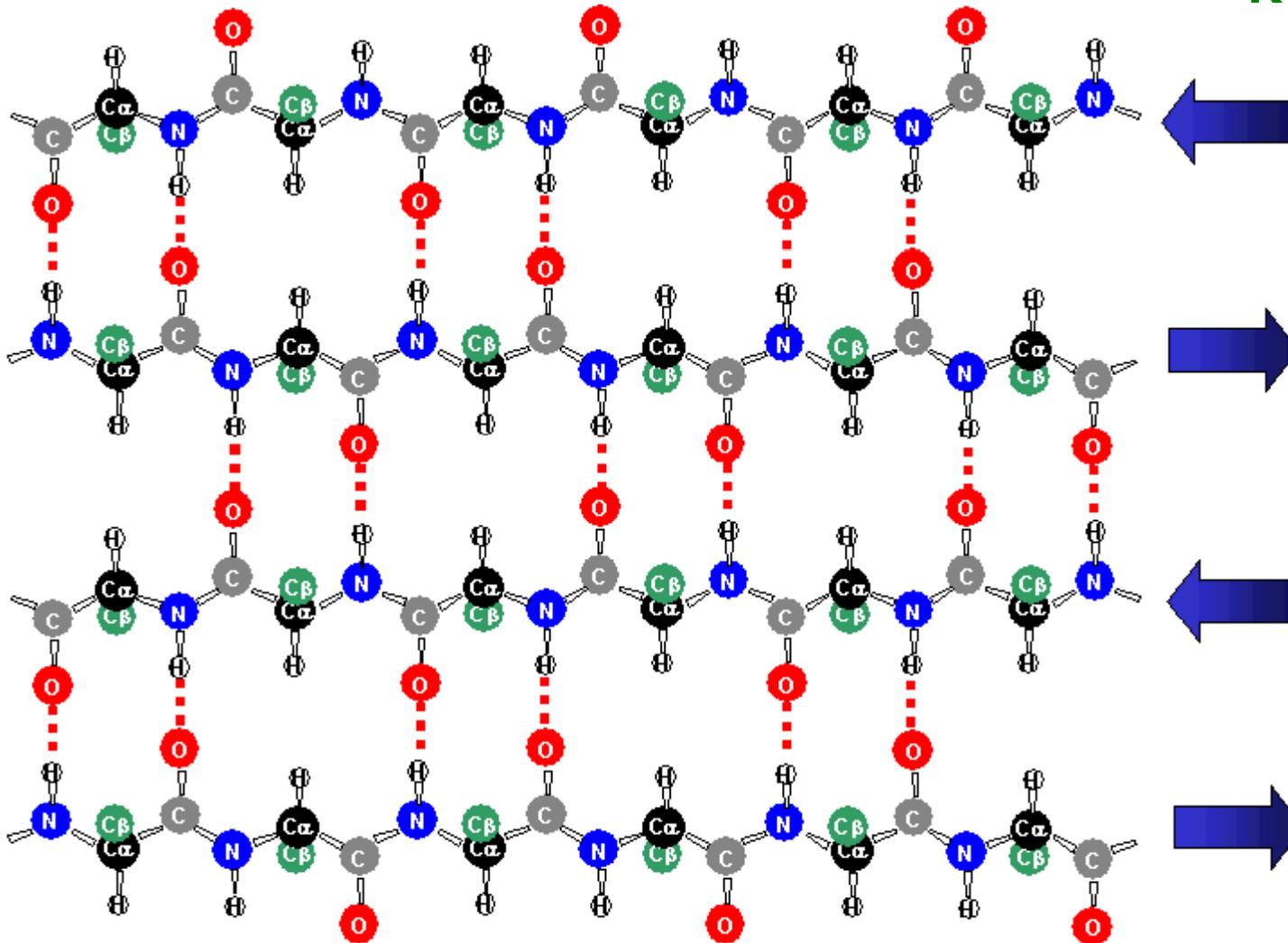
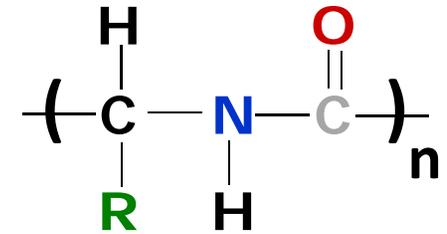


**SINTÉTICOS**

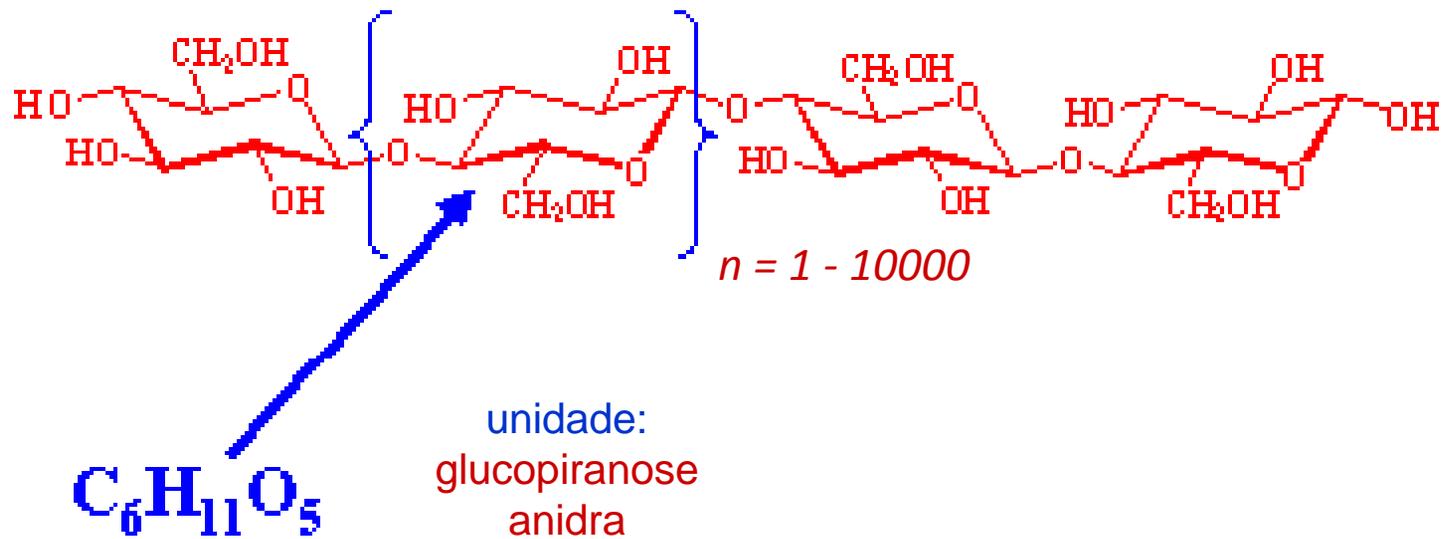
(PS, PE, TEFLON, KEVLAR)

# Polímeros Naturais

Estrutura de uma proteína  
(poliamida)

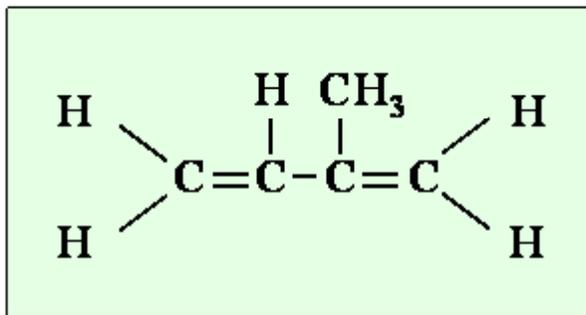
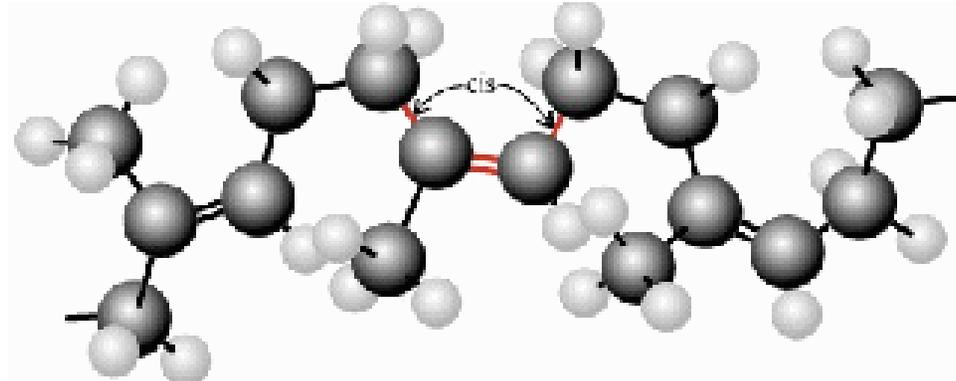
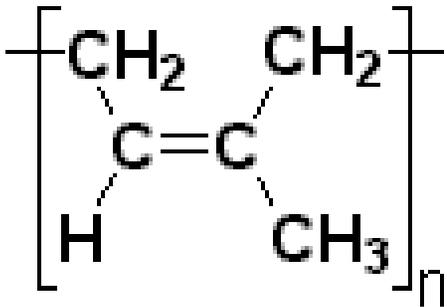


## Estrutura Molecular de Celulose



*Polímero de glucose (açúcar)*

## Borracha Natural: poli-isopreno (cis)



Monómero: **isopreno**

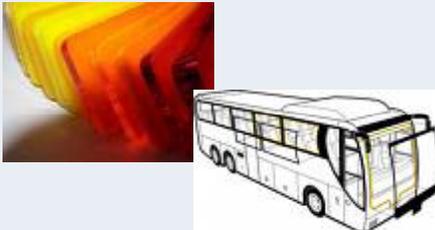
# Polímeros Sintéticos

## I. Reações de Adição

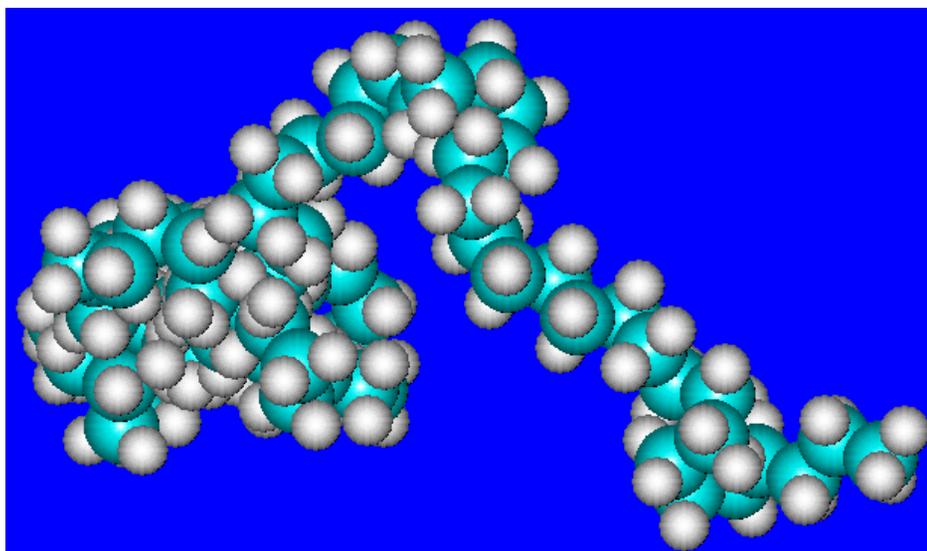
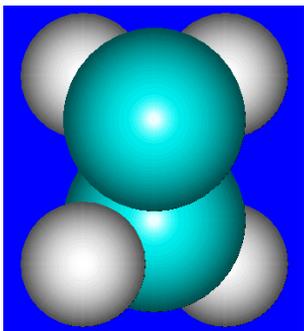


## Polímeros Sintéticos obtidos por Adição

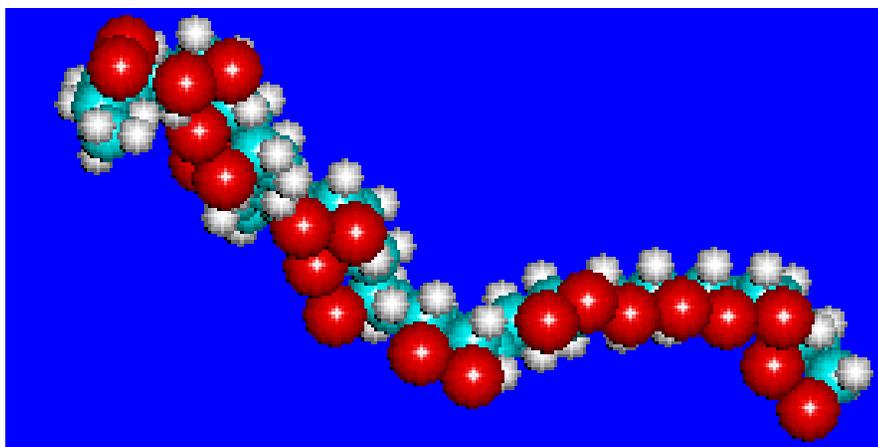
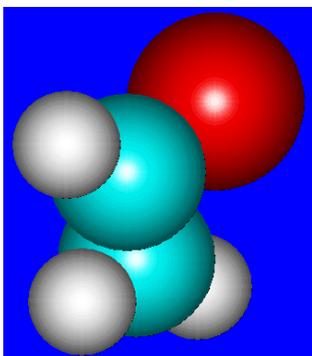
Monómero	Polímero	Aplicações
$\begin{array}{c} \text{H} & & \text{H} \\ & \backslash & / \\ & \text{C} = \text{C} \\ & / & \backslash \\ \text{H} & & \text{H} \end{array}$ <p>Etileno</p>	$\begin{array}{c} \text{H} & \text{H} \\   &   \\ \text{---}(\text{C} - \text{C})_n \\   &   \\ \text{H} & \text{H} \end{array} \quad \text{ou} \quad \left( \begin{array}{c} \text{H} & \text{H} \\ \diagdown & / \\ \text{C} & - & \text{C} \\ / & \diagdown \\ \text{H} & & \text{H} \end{array} \right)_n$ <p>Polietileno (PE)</p>	
$\begin{array}{c} \text{H} & & \text{H} \\ & \backslash & / \\ & \text{C} = \text{C} \\ & / & \backslash \\ \text{H} & & \text{Cl} \end{array}$ <p>Cloreto de vinilo</p>	$\begin{array}{c} \text{H} & \text{H} \\   &   \\ \text{---}(\text{C} - \text{C})_n \\   &   \\ \text{H} & \text{Cl} \end{array}$ <p>Policloreto de vinilo (PVC)</p>	
$\begin{array}{c} \text{H} & & \text{H} \\ & \backslash & / \\ & \text{C} = \text{C} \\ & / & \backslash \\ \text{H} & & \text{C}_6\text{H}_5 \end{array}$ <p>Estireno</p>	$\begin{array}{c} \text{H} & \text{H} \\   &   \\ \text{---}(\text{C} - \text{C})_n \\   &   \\ \text{H} & \text{C}_6\text{H}_5 \end{array}$ <p>Polistireno (PS)</p>	
$\begin{array}{c} \text{H} & & \text{H} \\ & \backslash & / \\ & \text{C} = \text{C} \\ & / & \backslash \\ \text{H} & & \text{CN} \end{array}$ <p>Acrilonitrilo</p>	$\begin{array}{c} \text{H} & \text{H} \\   &   \\ \text{---}(\text{C} - \text{C})_n \\   &   \\ \text{H} & \text{CN} \end{array}$ <p>Poliacrilonitrilo</p>	

Monómero	Polímero	Aplicações
$\begin{array}{c} \text{H} \quad \text{H} \\ \diagdown \quad / \\ \text{C} = \text{C} \\ / \quad \diagdown \\ \text{H} \quad \text{CH}_3 \end{array}$ <p>Propileno</p>	$\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{-(C-C)}_n \\   \quad   \\ \text{H} \quad \text{CH}_3 \end{array}$ <p>Polipropileno (PP)</p>	
$\begin{array}{c} \text{H} \quad \text{CH}_3 \\ \diagdown \quad / \\ \text{C} = \text{C} \\ / \quad \diagdown \\ \text{H} \quad \text{COOCH}_3 \end{array}$ <p>Metil metacrilato</p>	$\begin{array}{c} \text{H} \quad \text{CH}_3 \\   \quad   \\ \text{-(C-C)}_n \\   \quad   \\ \text{H} \quad \text{COOCH}_3 \end{array}$ <p>Polimetilmetacrilato (PMMA)</p>	
$\begin{array}{c} \text{F} \quad \text{F} \\ \diagdown \quad / \\ \text{C} = \text{C} \\ / \quad \diagdown \\ \text{F} \quad \text{F} \end{array}$ <p>Tetrafluoroetileno</p>	$\begin{array}{c} \text{F} \quad \text{F} \\   \quad   \\ \text{-(C-C)}_n \\   \quad   \\ \text{F} \quad \text{F} \end{array}$ <p>Politetrafluoroetileno (PTFE)</p>	

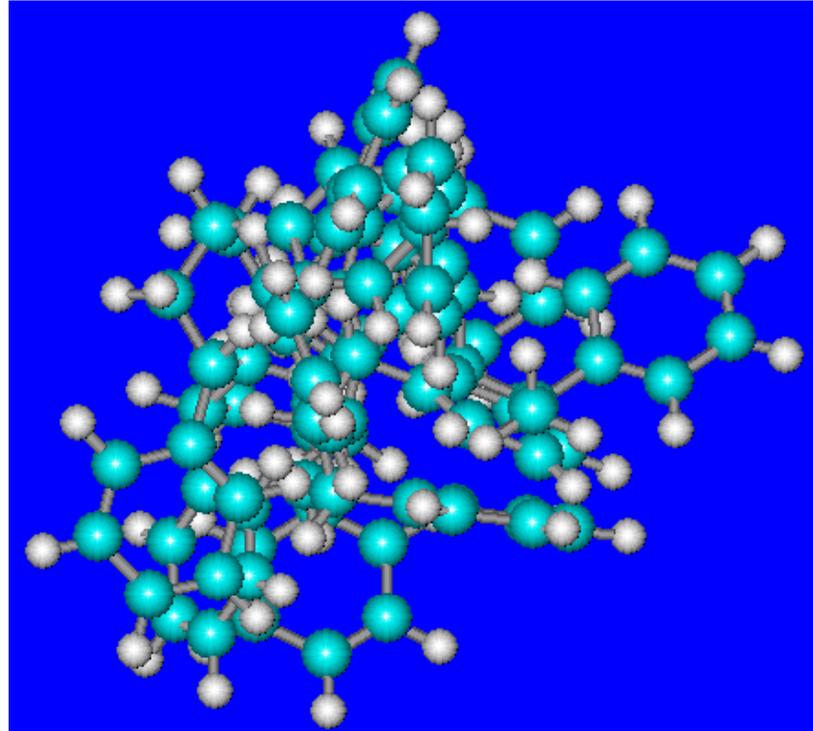
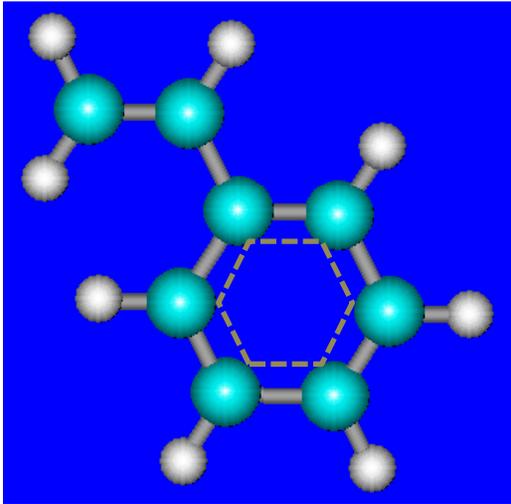
## POLIETILENO (PE)



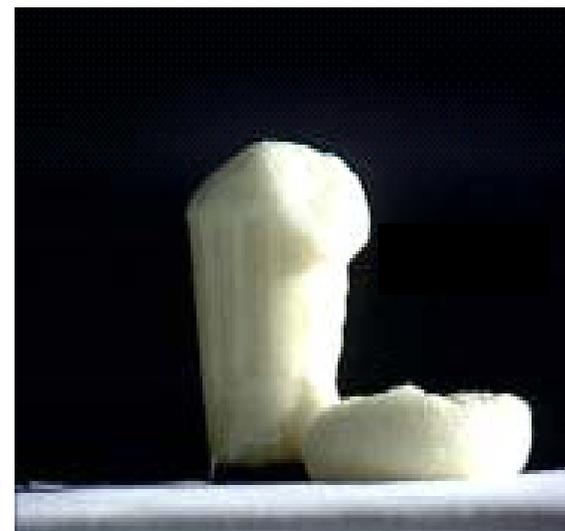
## POLICLORETO DE VINILO (PVC)



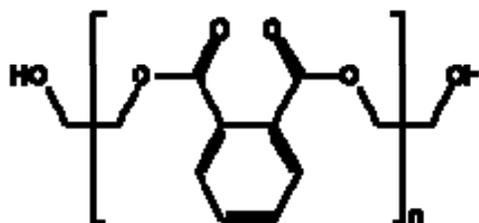
## POLIESTIRENO (PS)



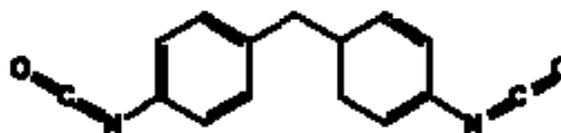
# Poliuretano



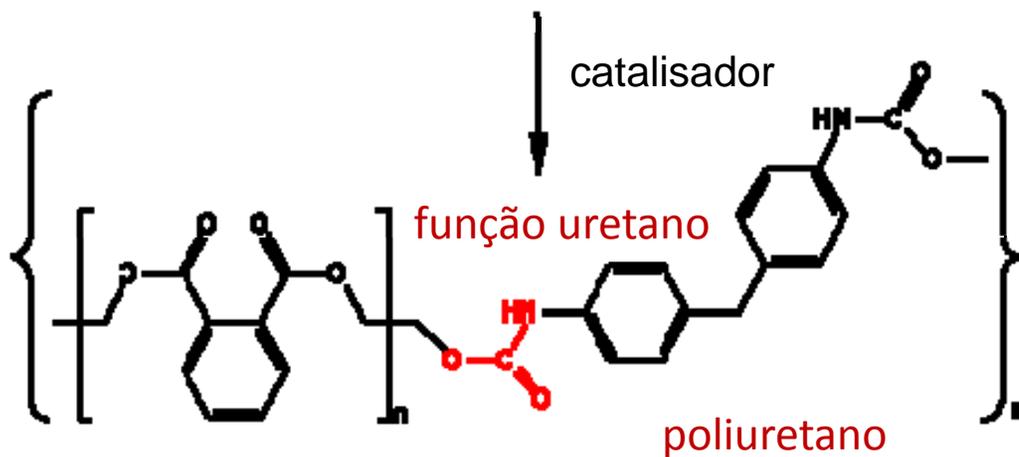
Componente A  
(diálcool)



Componente B  
(diisocianato)



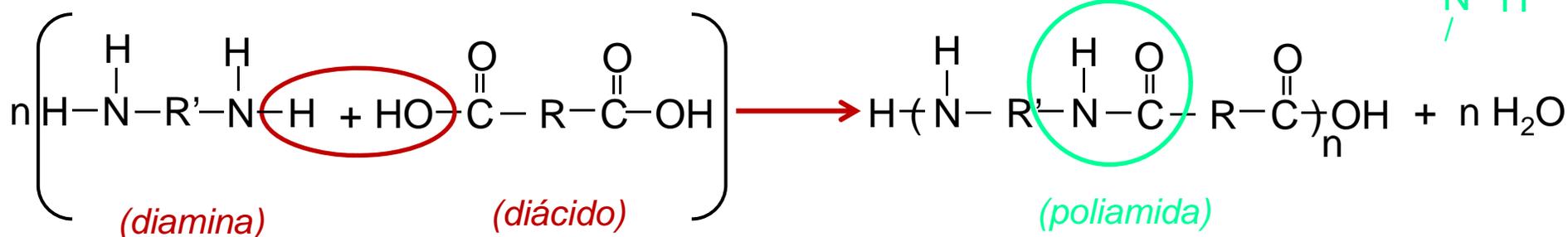
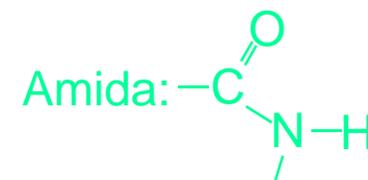
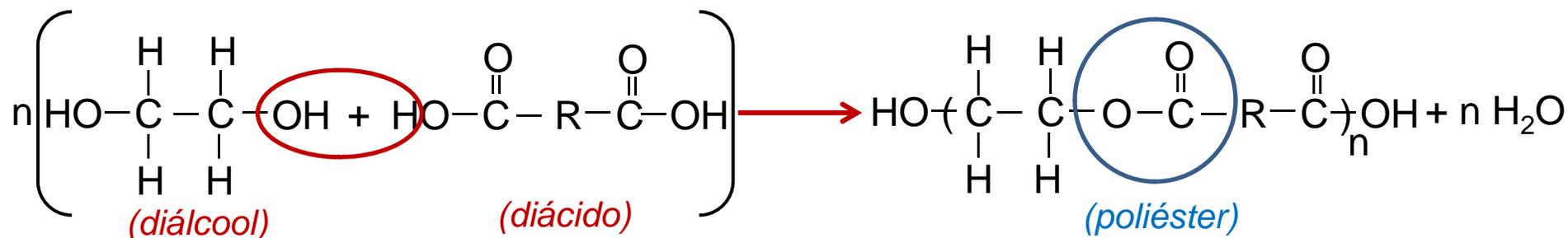
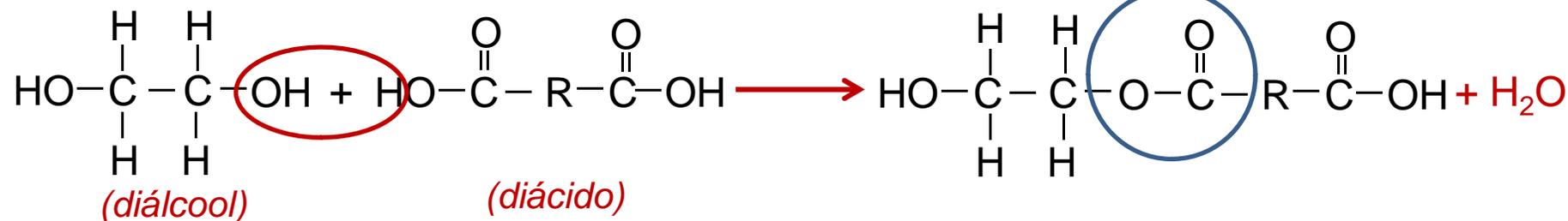
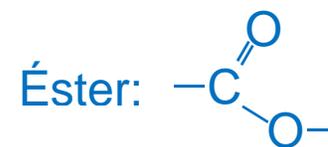
catalisador



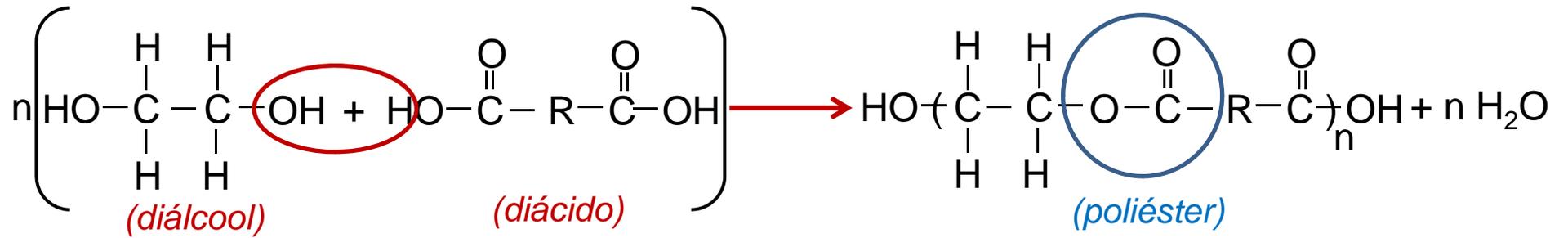
- Espumas
- Licra (spandex)

# Polímeros Sintéticos

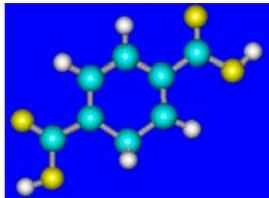
## II. Reacções de Condensação



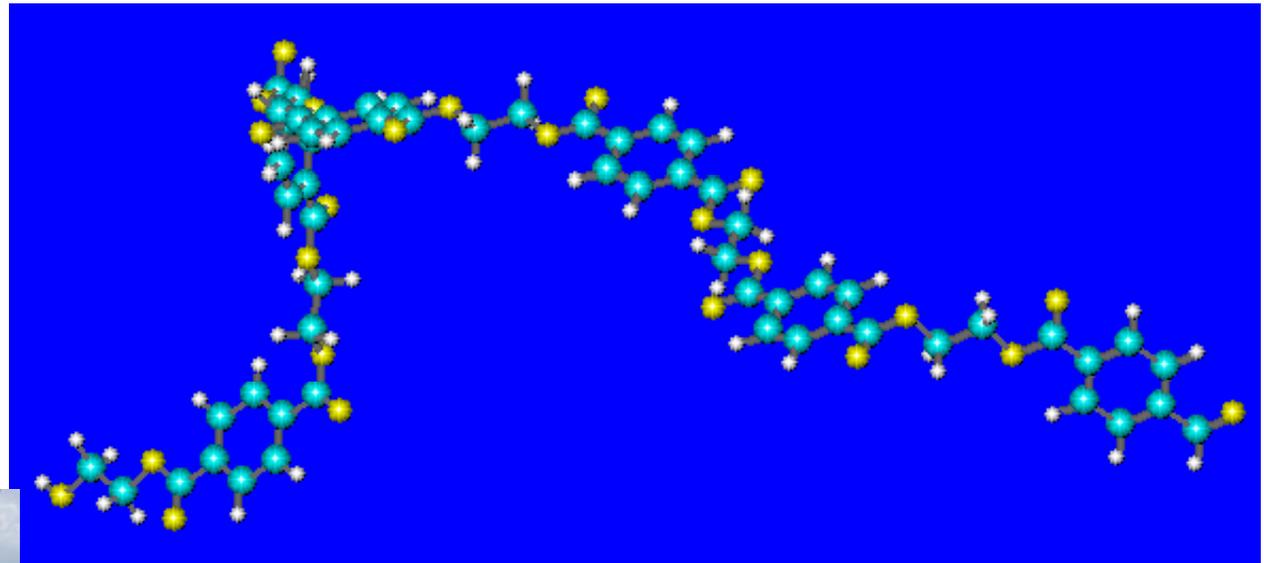
# Poliésteres



Se:  
R = C<sub>6</sub>H<sub>4</sub>



Dacron



Dacron: An American Original.



As inspired by  
Frank Lubertus

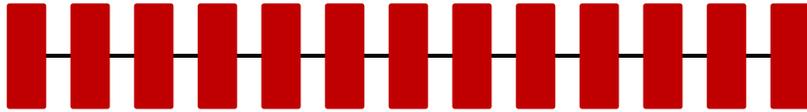




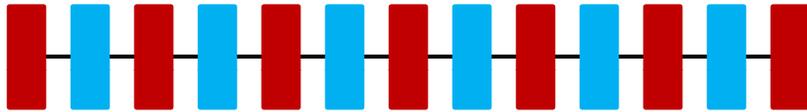


# Estrutura Molecular dos Polímeros

Homopolímero



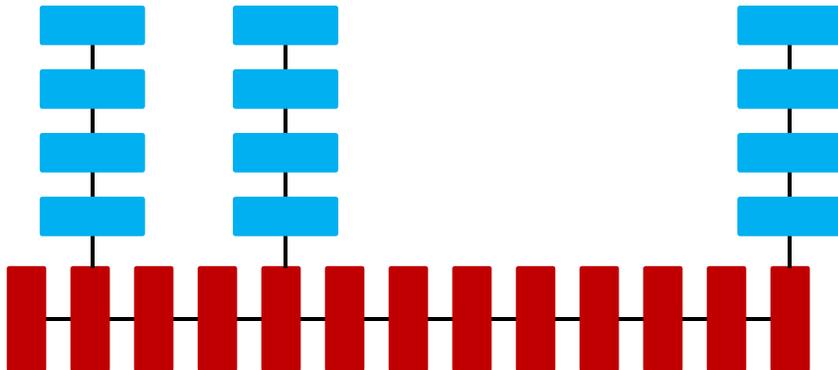
Copolímeros



Copolímero Alternado

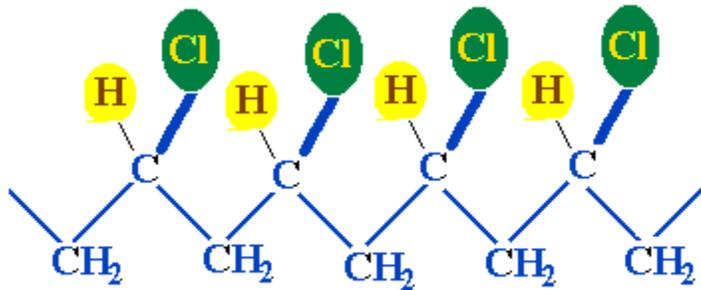


Copolímero em blocos

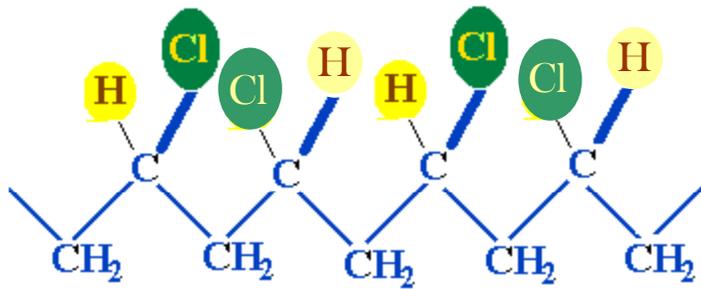


Copolímero enxertado

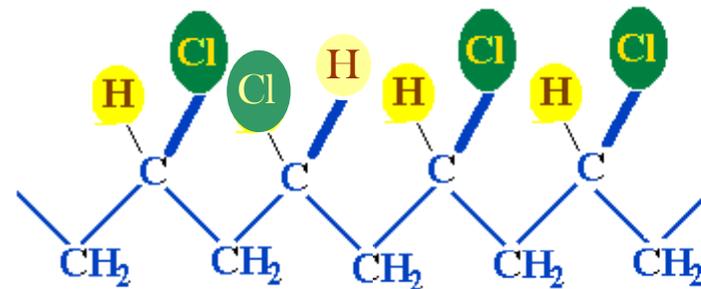
## Estereo-regularidade



Isotático

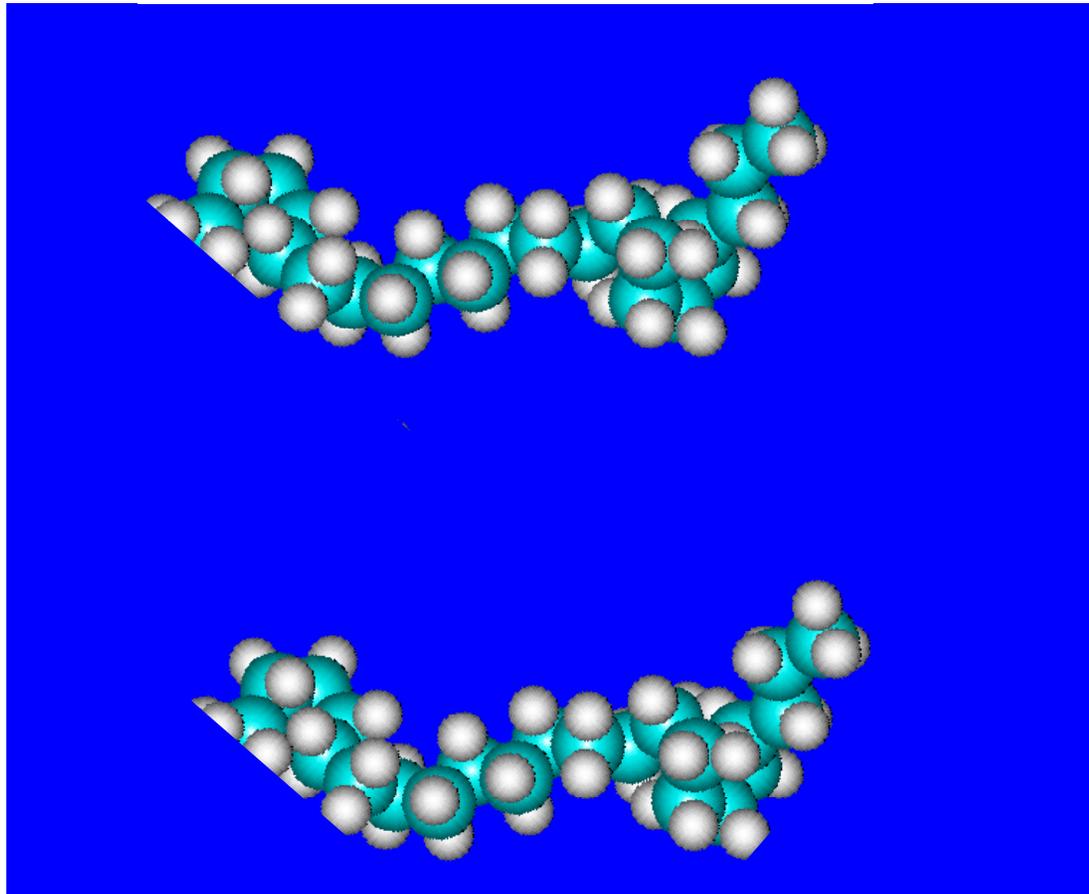


Sindiotático



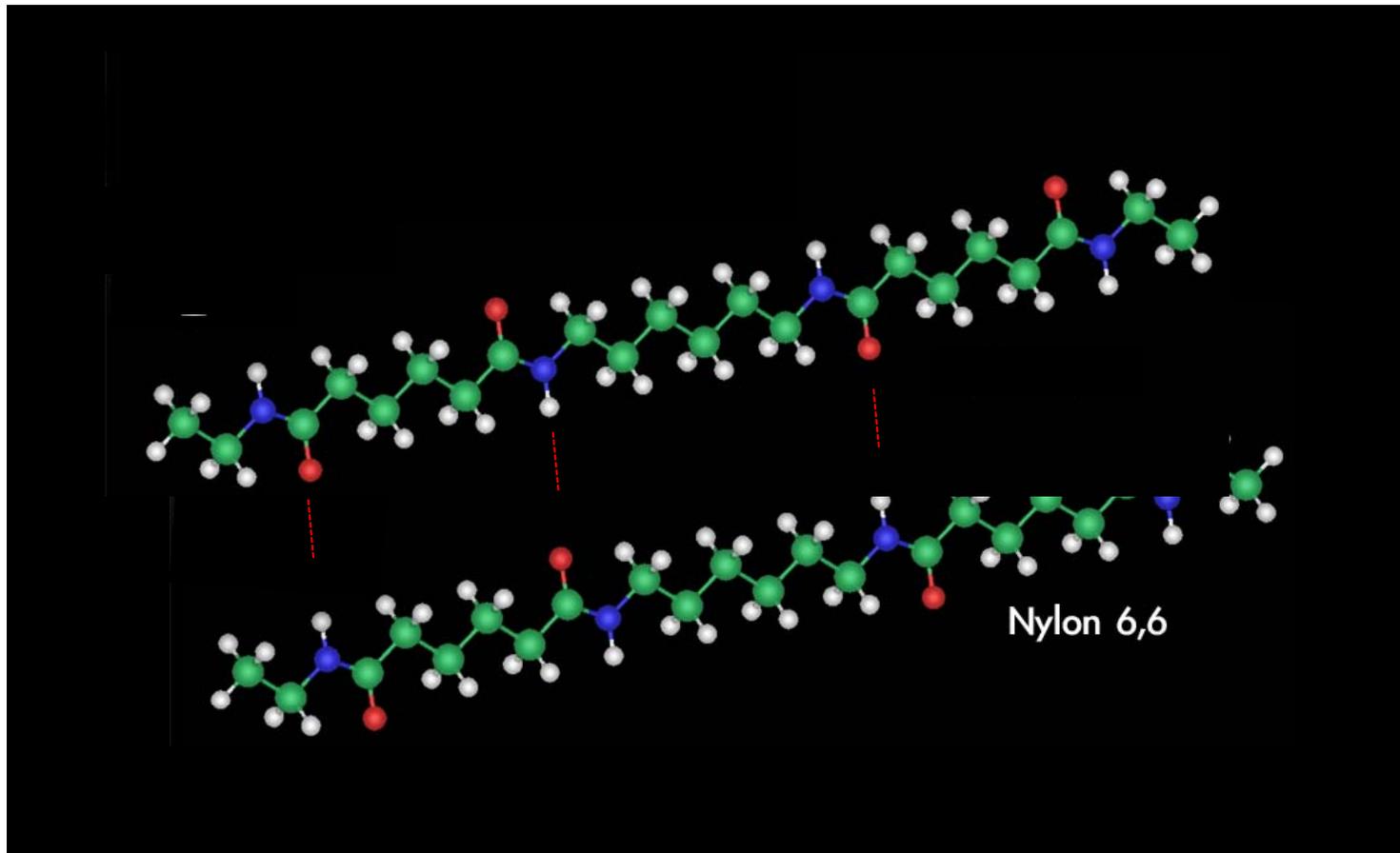
Atático

## Forças intermoleculares entre cadeias de polímero



**Interações de London muito fortes**

## Forças intermoleculares entre cadeias de polímero

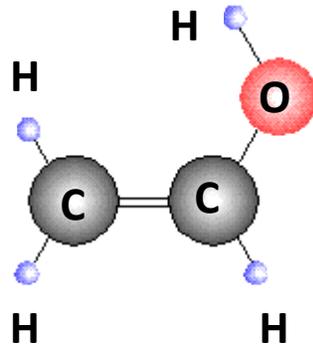


Interacções por ligação de hidrogénio

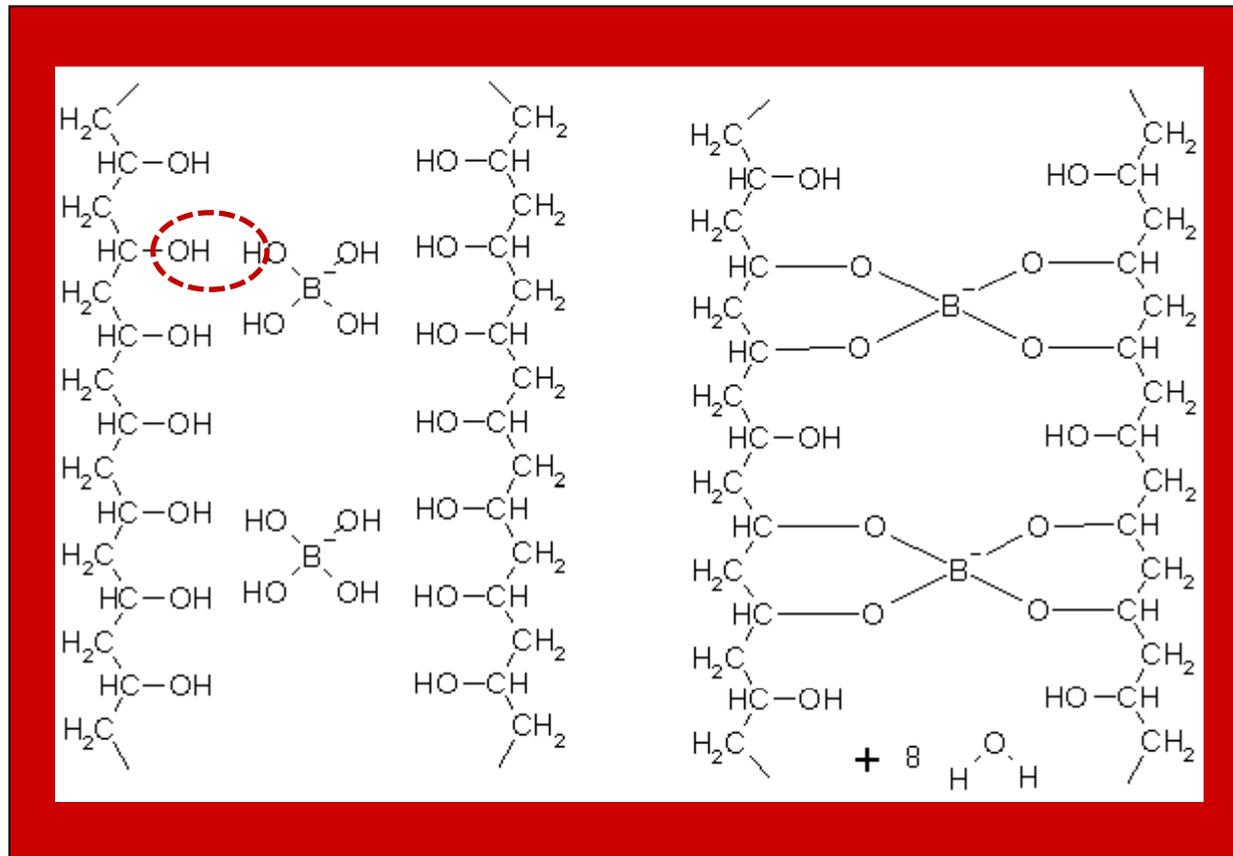
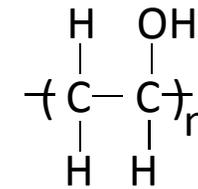
# Ligações cruzadas

Ex: Poli-álcool vinílico (PVA):

Monómero:



Polímero:



# SUMÁRIO 11

- **Polímeros**
  - **Polímeros Naturais e Sintéticos. Exemplos**
  - **Reacções de Polimerização**
    - Adição. Exemplos
    - Condensação. Exemplos
  - **Estrutura e Morfologia dos Polímeros**
    - Pesos Moleculares Médios:  $M_n$  e  $M_w$
    - Homopolímeros e Copolímeros
    - Tacticidade
  - **Forças Intermoleculares**
  - **Polímeros com Ligações Cruzadas. Exemplos**