

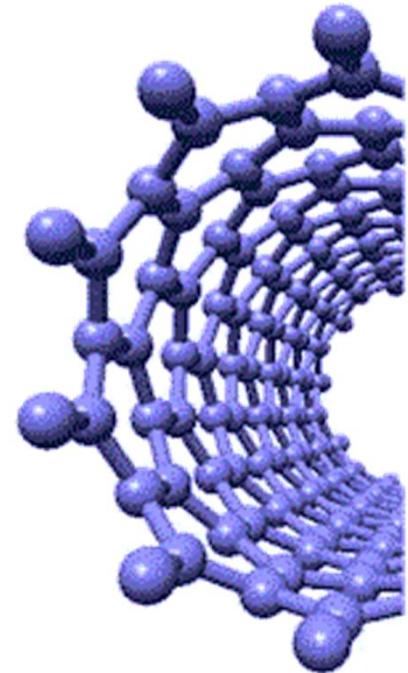


INVESTMENTS IN EDUCATION DEVELOPMENT

# Innovation and Development of Study Field Nanomaterials at the Technical University of Liberec

[nano.tul.cz](http://nano.tul.cz)

These materials have been developed within the ESF project: Innovation and development of study field Nanomaterials at the Technical University of Liberec



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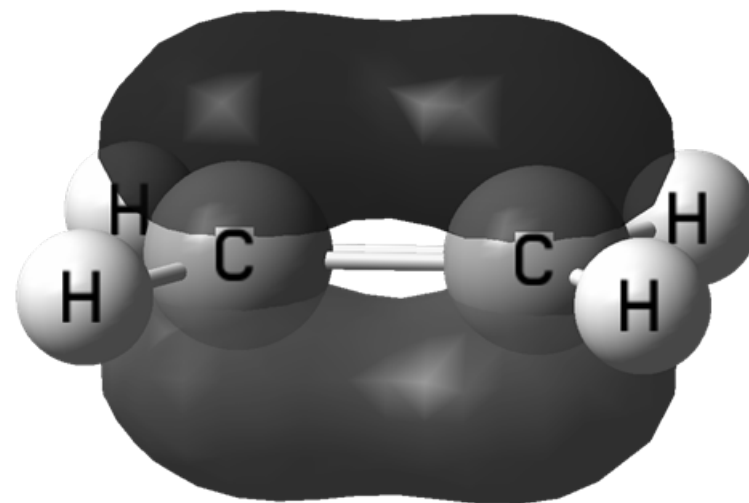
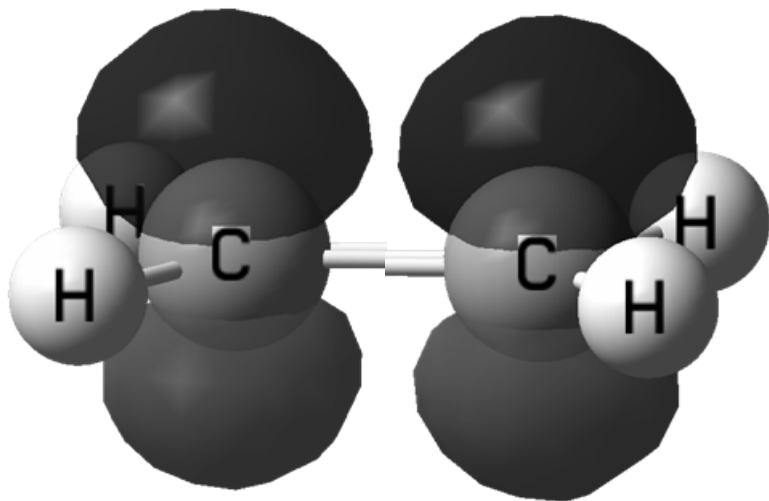


- **alkenes (double bonds)**  $A_E$
- structure of double bond
- stereochemistry of double bond
- addition reaction
- mechanism of additions to double bond
- orbital view of addition reaction



## Alkenes

$\pi$ -electrons are responsible for reactivity of alkenes



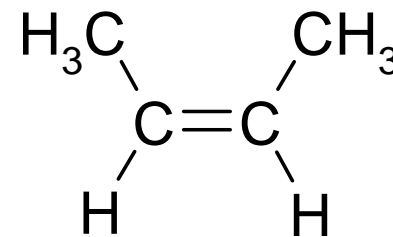
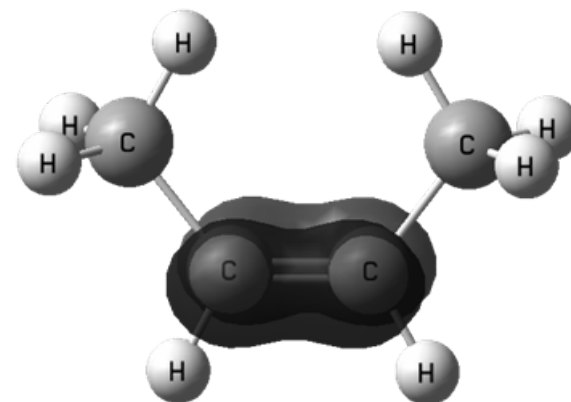
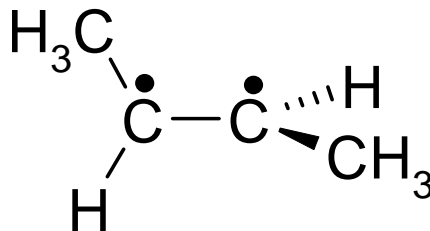
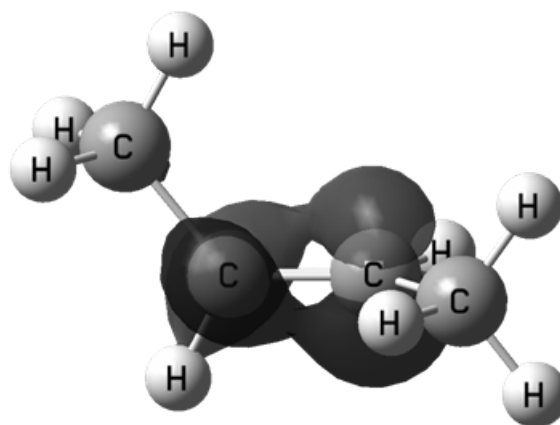
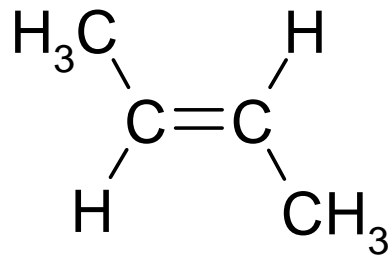
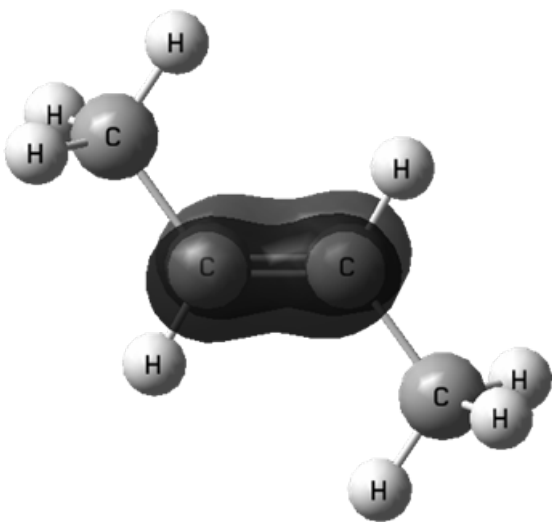


# Organic Chemistry – functional groups



## Alkenes

$\pi$ -electrons in *cis*- to *trans*- transformation

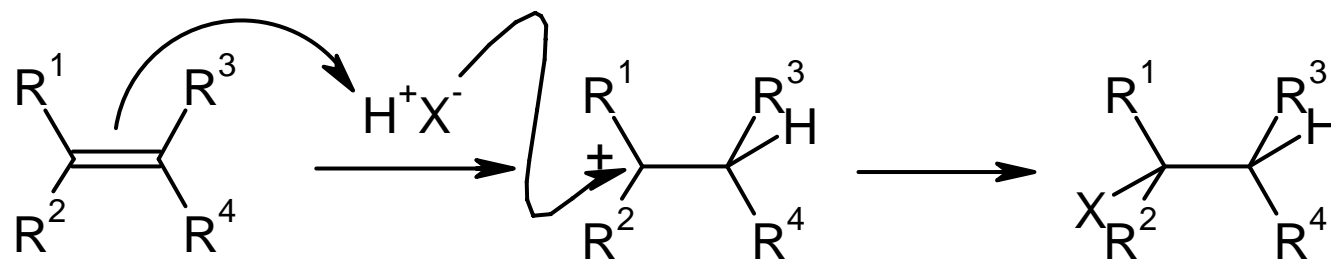




## Alkenes

### Addition electrophilic

- the most important alkene's type of reaction
- protic reagents – easily understandable



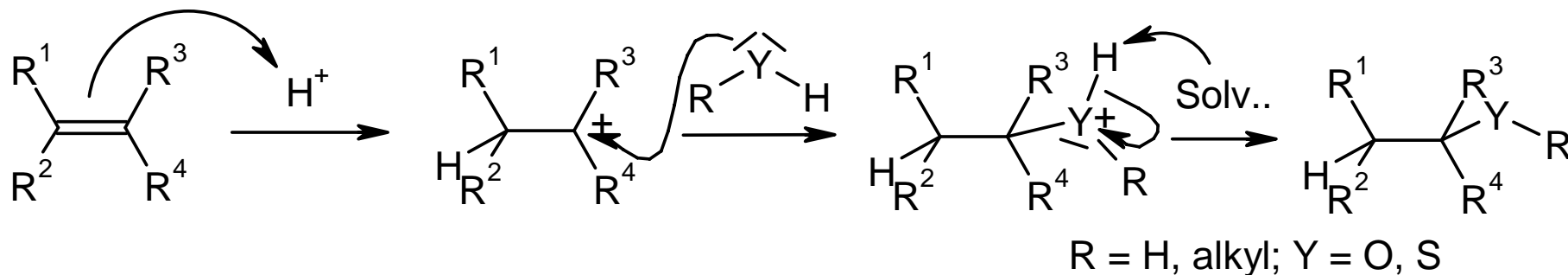
Reaction of alkenes with protic reagents



## Alkenes

### Addition electrophilic

- the most important alkene's type of reaction
- catalysis by mineral acid



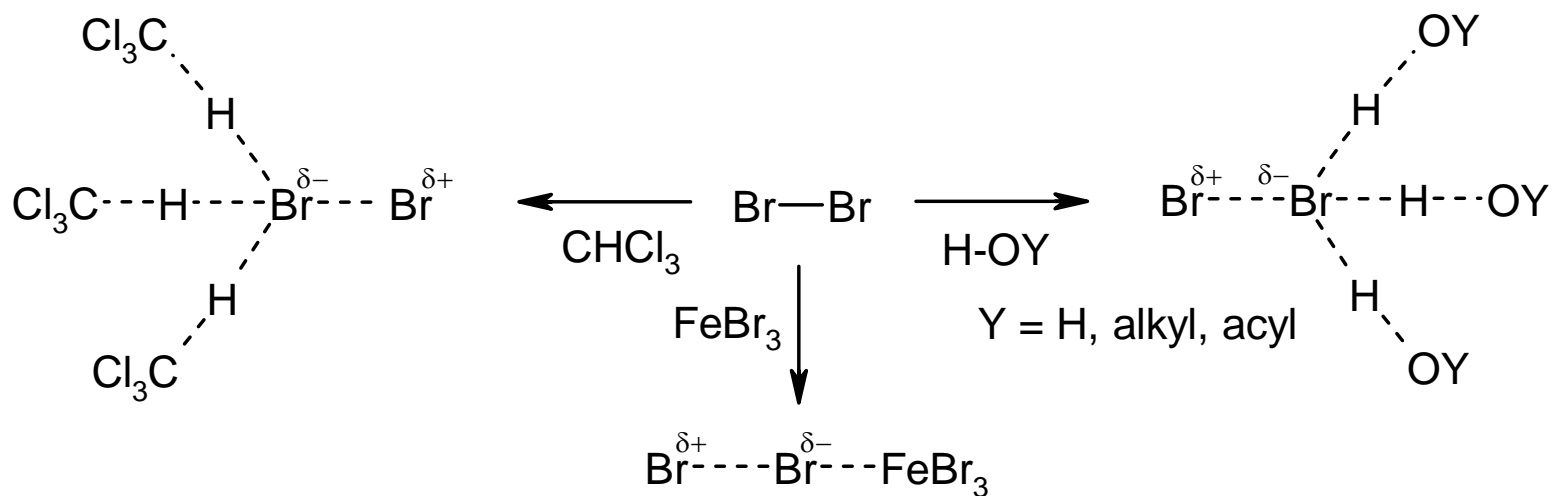
Reaction of alkenes with protic reagents - catalysis by mineral acid



## Alkenes

Addition electrophilic

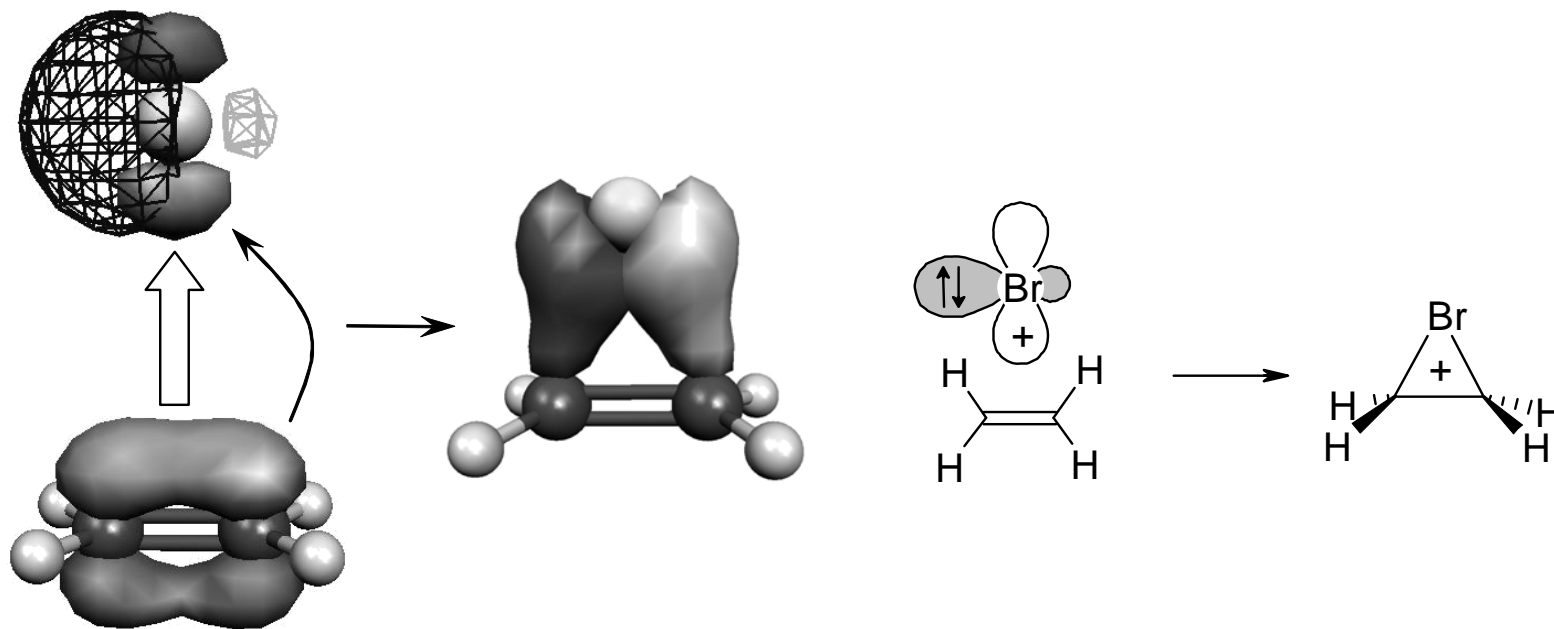
- *in situ* formation of electrophile (nucleophile)
- possible role of Lewis acid





## Alkenes

### Addition electrophilic – orbital description







## Alkenes

### Addition electrophilic – three-centered intermediate

