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## Objectivities for Thermal Chemical Research

->Next 20 years energy consumption in the U.S is projected to rise by 30% with energy production only to grow 25%.

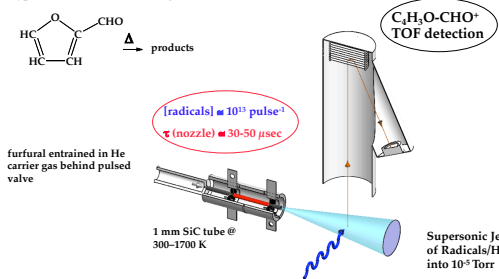
- Biofuels via Biomass (Cellulosic Ethanol).
- Reduce the Price of EtOH per gallon by 2012

- 30 x 30 – Produce enough EtOH to displace 30% of our current gasoline consumption by the year 2030.

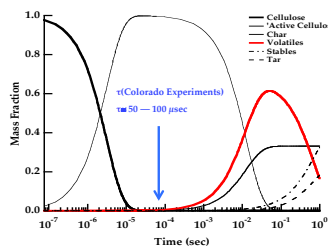
- Biomass is plant material: agricultural crops, trees, and grasses. Structural polymers — cellulose, hemicellulose, and lignin
- Thermochemical processing converts solid biomass → clean liquid fuels and chemicals. All from local sources in a way that reduces dependence on carbon stored over geological times.
- All thermal methods use heat to break the chemical bonds of large structural biopolymers → smaller semi-volatile or volatile units & "char".

## Experimental Apparatus

Hyperthermal Nozzle cracking:

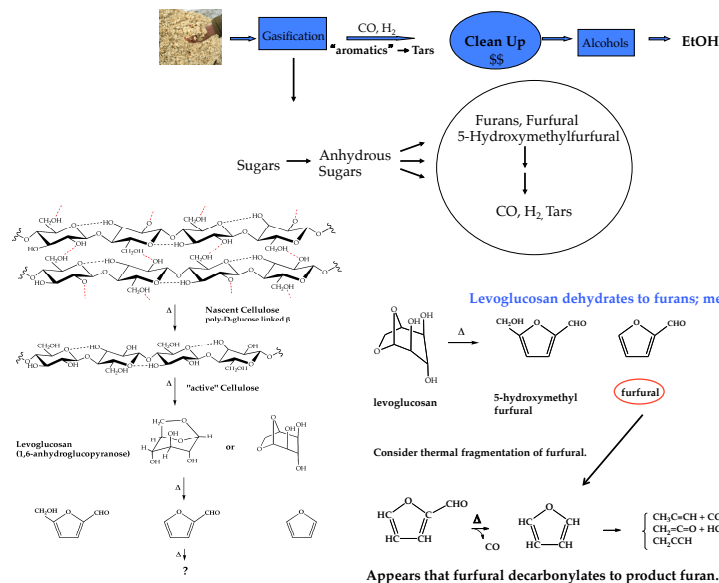


118.2 nm VUV Photoionization Laser (10.487 eV)

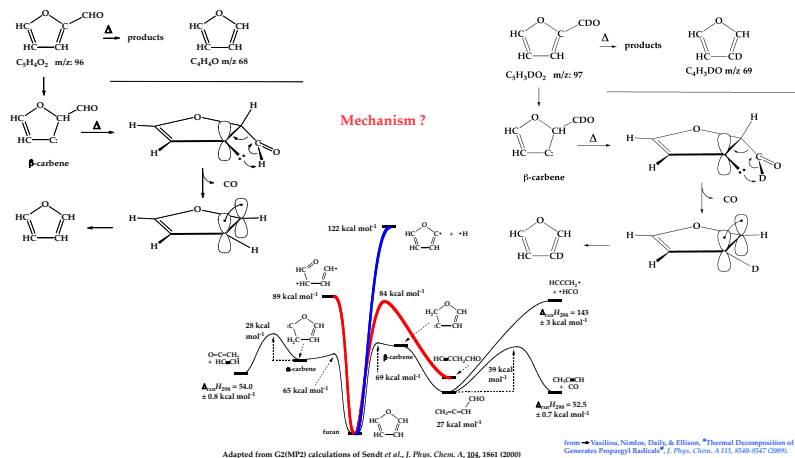


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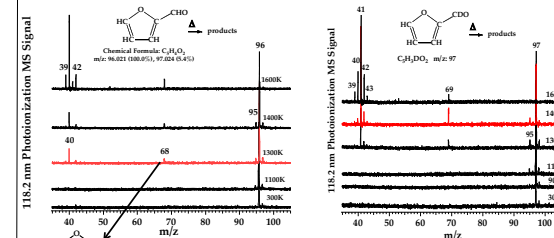
## Ethanol Production



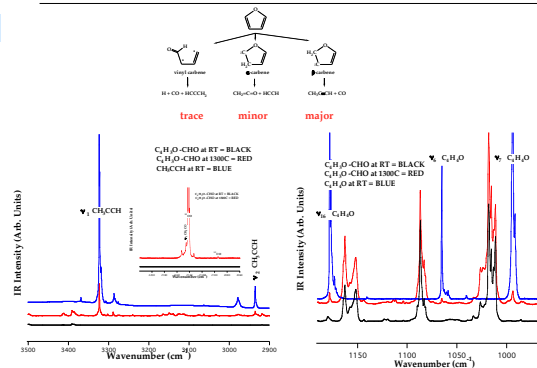
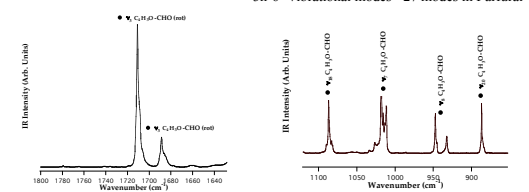
## Thermochemical Decomposition



## Pyrolysis of Furfural



3n-6=Vibrational modes =27 modes in Furfural



## Conclusions/Future

- Furfural thermally initially cracks to produce furan
- Further thermal cracking of furan produces:  $[CH_2CCH + CO] + [CH_2=C=O + HCCH]$

• Matrix IR of:

