

Chemical Engineering 522

Combustion Processes

Combustion and Energy



What is combustion?

- What is combustion?
- How can we define it?
- What are its properties and characteristics?
- How do we know something is combustion and when it is not?



Web Definitions

- a process in which a substance reacts with oxygen to give heat and light
- a state of violent disturbance and excitement; "combustion grew until revolt was unavoidable"
- burning: the act of burning something; "the burning of leaves was prohibited by a town ordinance"
wordnetweb.princeton.edu/perl/webwn
- Combustion 2008 is the newest version of Autodesk's visual effects and compositing software tool.
[en.wikipedia.org/wiki/Combustion_\(software\)](http://en.wikipedia.org/wiki/Combustion_(software))
- Combustion is the ninth album by aggrotech duo Decoded Feedback, the seventh full-length CD, and the second released on Germany's Out of Line record label.
[en.wikipedia.org/wiki/Combustion_\(Decoded_Feedback_album\)](http://en.wikipedia.org/wiki/Combustion_(Decoded_Feedback_album))
- Combustion or burning is a complex sequence of exothermic chemical reactions between a fuel (usually a hydrocarbon) and an oxidant accompanied by ...
en.wikipedia.org/wiki/Combustion
- The act or process of burning; A process where two chemicals are combined to produce heat; A process wherein a fuel is combined with oxygen, usually at high temperature, releasing heat; Violent agitation, tumult
en.wiktionary.org/wiki/combustion
- Burning. Many important pollutants, such as sulfur dioxide, nitrogen oxides, and particulates (PM-10) are combustion products, often products of ...
www.smallbiz-enviroweb.org/compliance/glossary.html
- An exothermic chain reaction between oxidising and reducing agents, or between oxygen and fuel. combustion may occur with any organic compound, or ...
www.fire.org.uk/glossary.htm
- a chemical reaction between a fuel and oxygen which produces heat.
www.beacontx.com/id7.html
- the process of converting fuel into heat, requires oxygen.
www.dunkirk.com/heating_info_glossary.asp
- Chemical oxidation accompanied by the generation of light and heat.
www.natsource.com/markets/index.asp



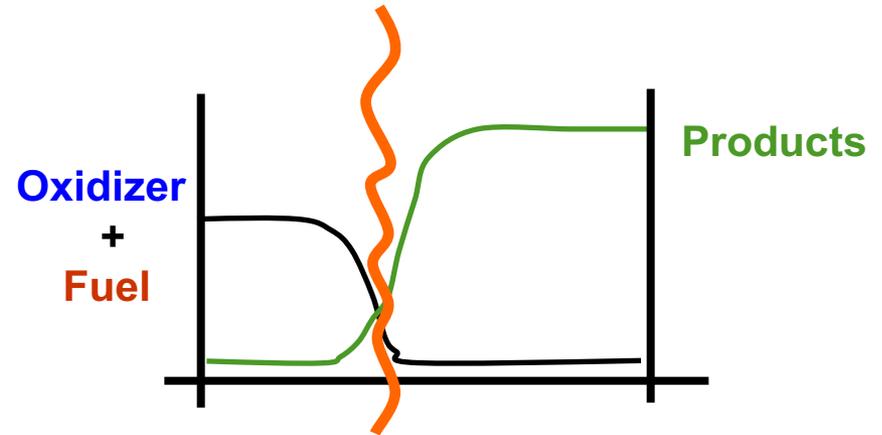
Turns' Definition

- Webster's
 - Rapid oxidation generating heat, or both light and heat; also, slow oxidation accompanied by relatively little heat and no light

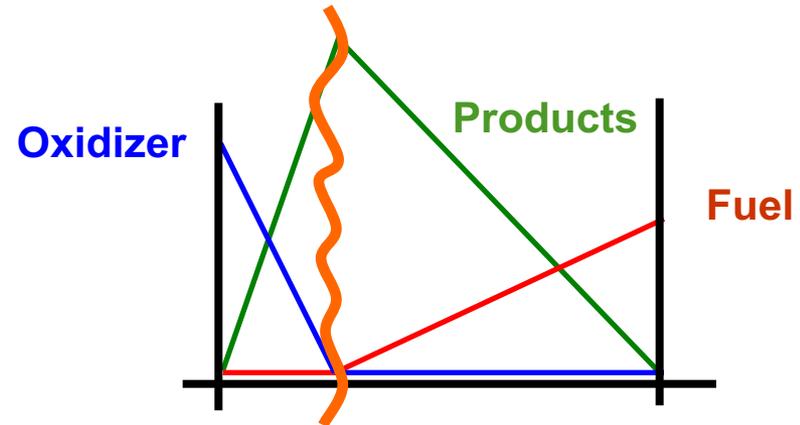


Premixed and Nonpremixed Flames

Premixed



Nonpremixed



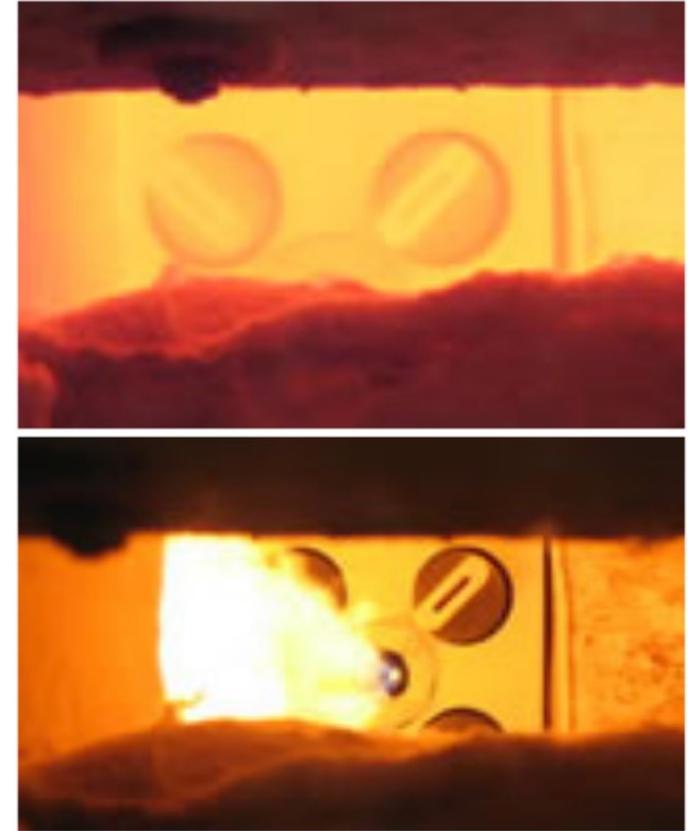
Flameless: HCCI

- Homogeneous charge compression ignition
- Gasoline engine: premixture, compress, then spark → premixed flame propagation
- Diesel engine: air, compress, then inject fuel which autoignites and burns as a nonpremixed flame
- HCCI, premixture compressed to autoignition point, homogeneous burning
 - Usually lean
 - Higher compression ratios, lower peak temperatures
 - High efficiency, low emissions
- Multi-fuel operation
- Hard to control, cold start issues



Flameless: MILD Combustion

- Moderate or intense low oxygen dilution
- Quickly mix fuel, air, and recirculated products.
 - High temperature (but lower than flames), and high dilution.
- Avoids flame extinction/reignition processes.
- Lower temperature, distributed reaction
- Reduce peak flame temperatures
- Reduce NO_x and soot emissions.
- Higher fuel flexibility



http://www.ifs.tohoku.ac.jp/enerdyn/en/en_researches_hicot.htm

