How Earth as a cooling star created alkenes (olefins).

Ivo van der Rijt.

06May2021.

Abstract

This paper describes various methods how Earth as a Cooling Star created alkenes.

Earth had various mechanisms to create double bond carbonchain molecules. The first 2 mechanisms are related to cracking. "Cracking" is used to describe any type of splitting of molecules under the influence of heat, catalysts and solvents, such as in processes of destructive ditillation or pyrolysis.

*)Cracking by very hot surfaces. At 450-750 degrees celcius and pressures up to 70 atm. (low -> high enthalpy, high ->low entropy) cracking of alkanes can take place creating alkenes. Under influence of a catalyst far lower temperatures are required for cracking. Inside a cooling star various temperature and pressure ranges are possible. Lava (molten rock) for example on Earth has a temperature from 700 to 1250 degrees Celcius. Pyrolysis is also called steam cracking (750 to 900 degrees Celcius). Earth had an inert (oxygen deprived) atmosphere when it was a younger star in which pyrolysis took place.

*)Cracking by Lightning. It is hypothized that lightning impacts on early Earth created enough phosphor in the atmosphere to phosphorilate various molecules in Earths prebiotic chemistry. See reference 1. Lightning however also heats the atmosphere it moves through. A bolt of lightning on Earth can reach 30000 degrees celcius. (50000 degrees fahrenheit) which is 5 times hotter then the surface of the sun. This electricity and heat can destroy alkanes to form smaller alkene structures.

*) Chemical reactions. Alkenes form as a byproduct in the Fisher-Tropsch synthesis. A metal catalyst such as iron can, not only weaken the carbonmonoxide bond in the Fischer–Tropsch synthesis, but also destroy the hydrogen-hydrogen bond of the hydrogengas in the process. There are a lot of routes to explain the formation of various alkenes in Fischer-Tropsch. I leave the correct explanation of byproduct formation to the expert chemists. Because, although seemingly a very simple process (hydrogen reacting with carbonmonoxide), it has a huge variety in described reactions and outcome. As for other chemical reactions: A star will also contain various dehyrogenation reactions, most of them are yet unknown.

*)Photochemistry.UV light can form free radicals inside a star such as Chlorine and Bromine radicals. These will break the C-H bond in alkanes forming alkyl halides. When heated with strong bases, alkyl halides typically undergo a 1,2-elimination reactions to generate alkenes. Light can also change the location of a double bond in a large alkene. There is plenty of light inside a cooling star.

*)Gravitational accelertion of large carbonchained molecules. Earth as a star captured a lot of material such as dust and gas via its gravity. This also included large carbonchained molecules. Fulerenes have been found in the interstellar medium and there are plenty or rocks floating around in space to capture. The Carbonchained molecules on and in these rocks undergo what astrochemists call a reset because they will be broken up in a stars atmosphere. Aside from the ionisation of these carboncompounds leading to alkenes, alkenes themselves where captured when Earth was a hotter younger star.

*)Pressure on large carbonchained molecules. A star has tremendous pressure that might crack longer molecules even absent of the temperature requirement. There is a lot to discover if we simply regard Earth as a cooling star.

Reference source:

*1) Hess, B.L., Piazolo, S. & Harvey, J. Lightning strikes as a major facilitator of prebiotic phosphorus reduction on early Earth. *Nat Commun* **12,** 1535 (2021).https://doi.org/10.1038/s41467-021-21849-2.

*2) Ivo van der Rijt. Vixra: 2104.0134. How the Earth as a Cooling Star Created Abiotic fuel.

*3) Wikipedia.