Claims

[Claim 1]

A direct cracking method of a hydrocarbon for directly cracking a hydrocarbon into carbon and hydrogen in each of a first reactor and a second reactor, the method comprising:

a step of continuously flowing a catalyst which is an unsupported catalyst comprising an aggregate of a plurality of metallic particles having an iron purity of 86% or more through the first reactor and then flowing the catalyst through the second reactor; and

a step of continuously flowing a feedstock gas containing a hydrocarbon through one of the first reactor or the second reactor and then flowing the feedstock gas through the other of the first reactor or the second reactor,

the feedstock gas and the catalyst coming into contact with each other in each of the first reactor and the second reactor under a condition that a pressure in the second reactor is higher than a pressure in the first reactor.

[Claim 2]

The direct cracking method of a hydrocarbon according to claim 1, wherein, when an atmospheric pressure is defined as P_0 kPa, the pressure in the first reactor is from P_0 kPa to (P_0 + 50) kPa, and the pressure in the second reactor is 3 MPa or less.

[Claim 3]

The direct cracking method of a hydrocarbon according to claim 2, wherein the pressure in the second reactor is determined by:

a step of determining a desired value X (%) for a conversion rate of methane in the second reactor;

a step of obtaining an equilibrium conversion rate Y (%) of methane at a temperature in the second reactor; and

a step of determining the pressure in the second reactor under conditions that $X \leq Y$.

[Claim 4]

The direct cracking method of a hydrocarbon according to any one of claims 1 to 3, wherein, in each of the first reactor and the second reactor, the feedstock gas and the catalyst come into contact with each other in a temperature ranging from 600°C to 900°C.

[Claim 5]

The direct cracking method of a hydrocarbon according to any one of claims 1 to 4, further comprising a step of supplying a part of an outflow gas flowing out of the second reactor to the first reactor.

[Claim 6]

The direct cracking method of a hydrocarbon according to claim 5, further comprising:

a step of separating the outflow gas into a hydrocarbon and hydrogen before the step of supplying the part of the outflow gas to the first reactor,

wherein the hydrocarbon-containing gas separated from the outflow gas is supplied to the first reactor.

[Claim 7]

The direct cracking method of a hydrocarbon according to any one of claims 1 to 4, wherein the feedstock gas is continuously flown in the second reactor and then flown in the first reactor.