ASSESSMENT OF PLASMA FORMATIONS IMPACT ON ELECTROPHYSICAL, ACOUSTIC AND GASDYNAMIC CHARACTERISTICS OF THE COMBUSTION CHAMBER

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Combustion with plasma formation allows to improve several parameters of process:

- Reduce preparation and mixing time
- Minimize ignition delay;
- Stabilization of ignition;
- More efficient combustion;
- Reduce the time of combustion;
- Reduce the volume of combustion;
- More effective chamber design;
- Another process control methods;
- Reduce noise.
- etc

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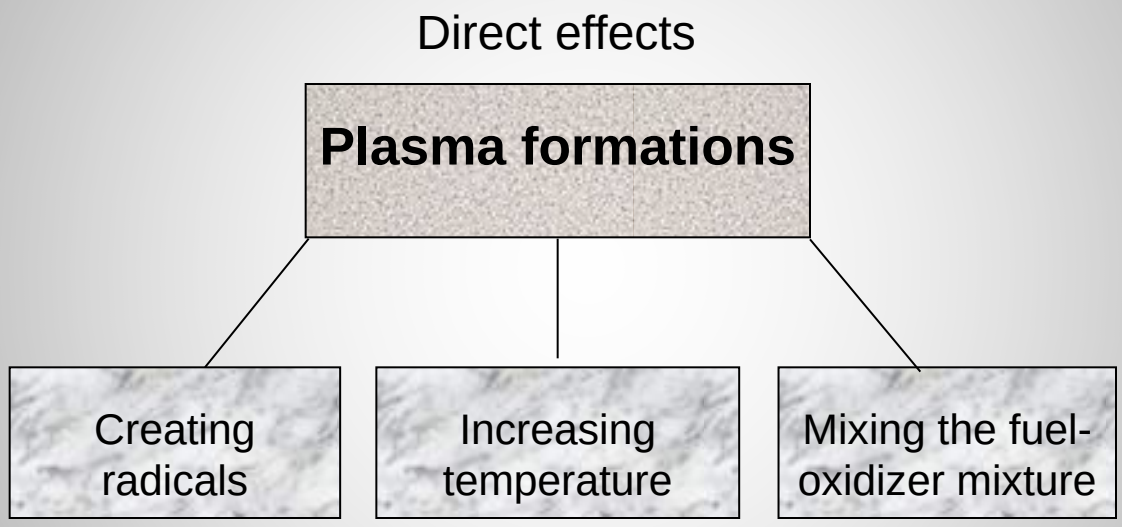

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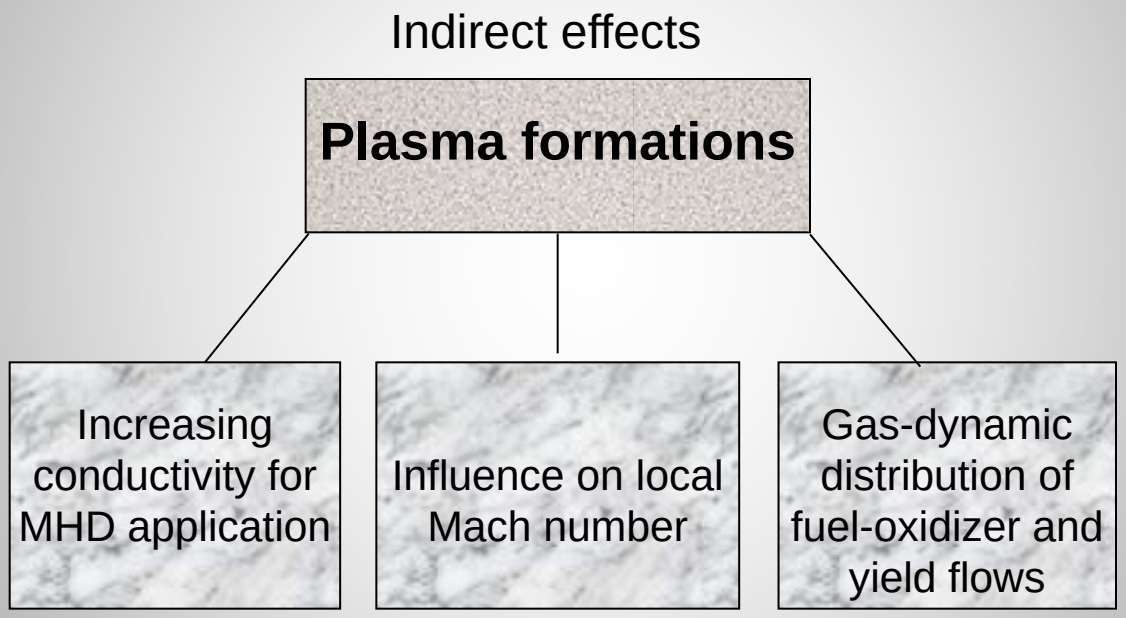

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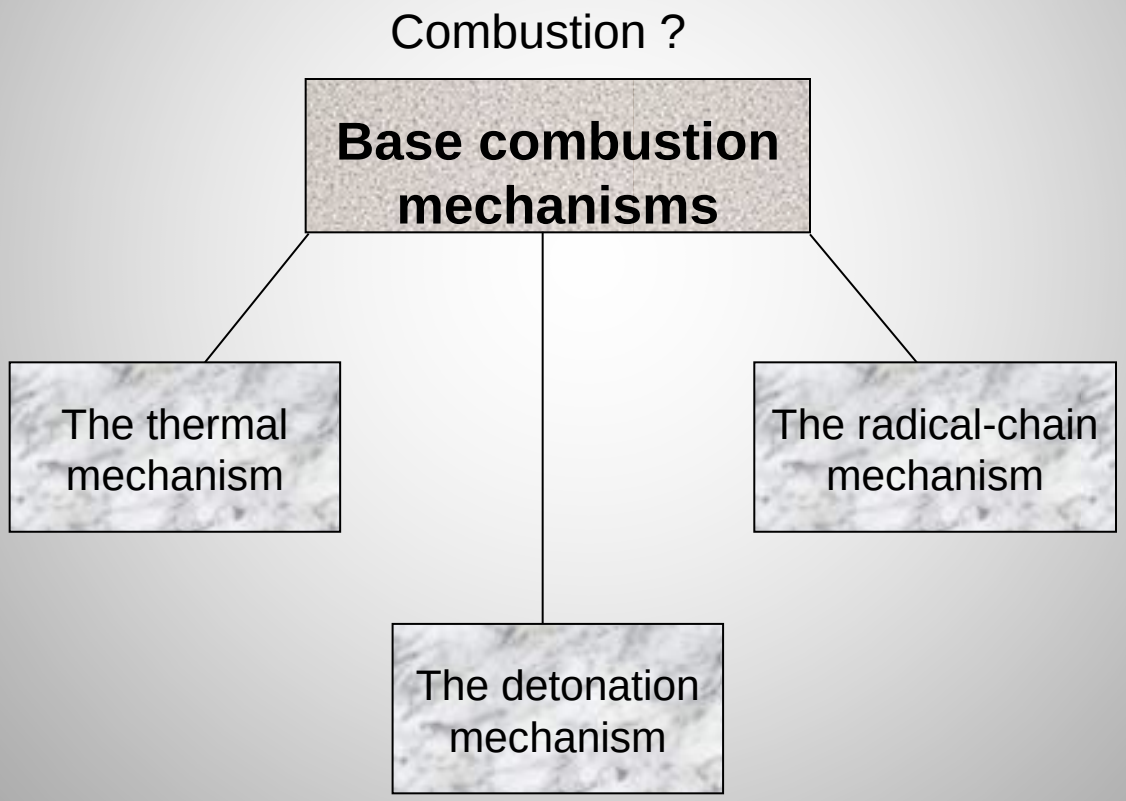

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Implementation of the thermal mechanism

- for ignition

$$q_+ > q_-$$

- for combustion

$$dq_+ / dt > dq_- / dt$$

q_+ - heating

q_- - cooling

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The chain mechanism of formation and destruction for active radicals:

$$\frac{dn}{dt} = q_0 + (f - g) \cdot n$$

Implementation of the radicals chain mechanism for ignition:

$$f > g$$

q_0 - external source of active radicals

f - rate of radicals production

g - rate of radicals disappearance of in the volume

n - the number of active radicals

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Implementation of the detonation mechanism for ignition:

$$t_r(P,T)\cdot D << R$$

R - radial coordinate of a spherical shock wave

D - shock wave propagation velocity

t_r - ignition delay time due to relaxation processes

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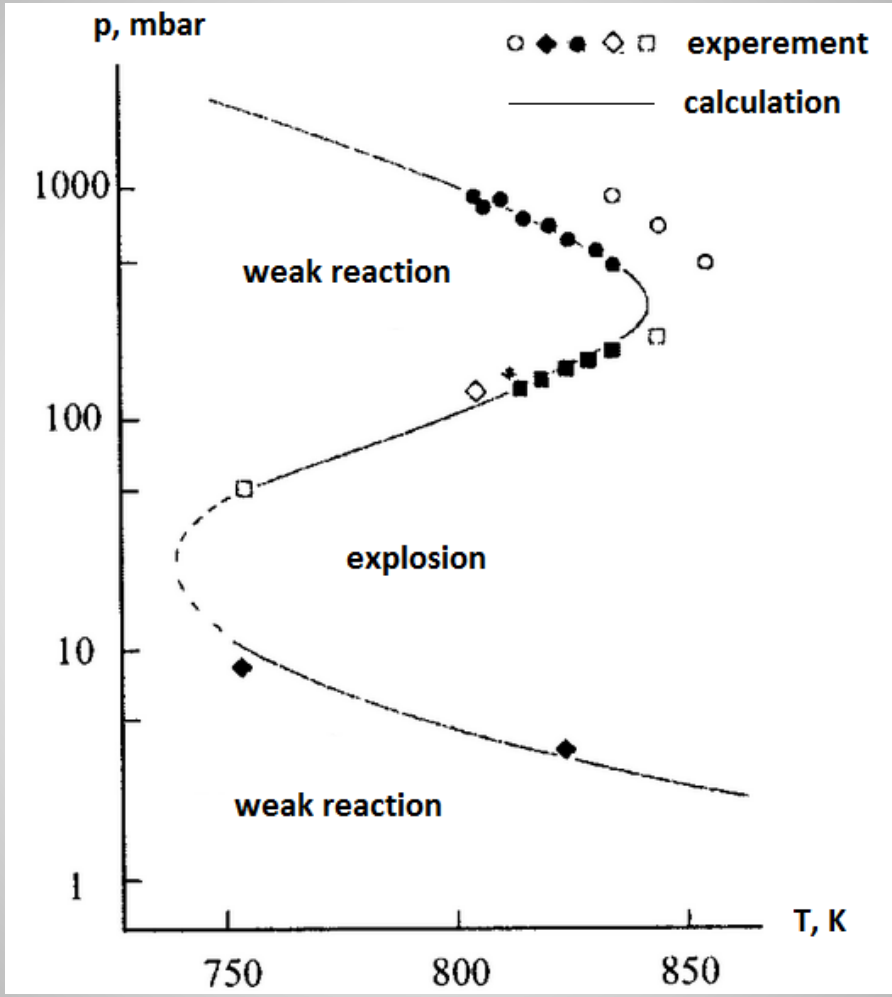

P-T diagram for ignition limits of hydrogen-oxygen mixture (Maas, Waarnatz, 1988)

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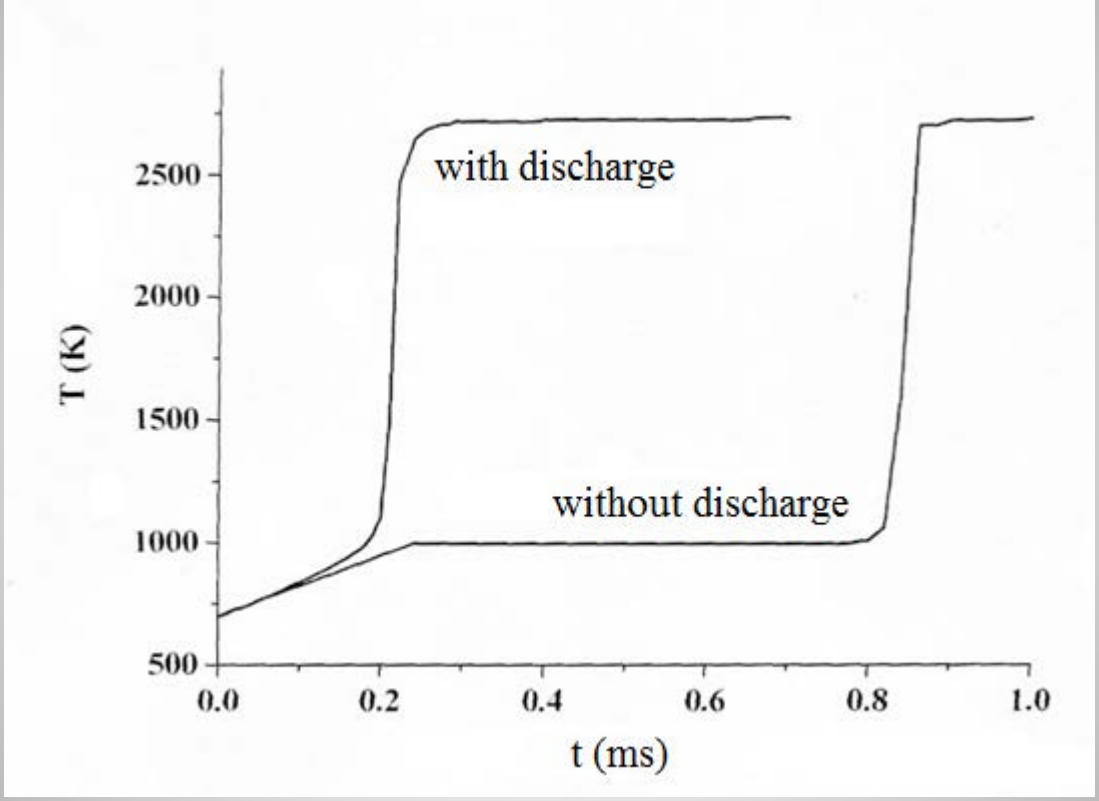

Temperature of mixture during ignition, discharge 0.24ms, the mixture H2:O2:N2 (0.28: 0.14:0.58), *P=1atm, T0=700K.*

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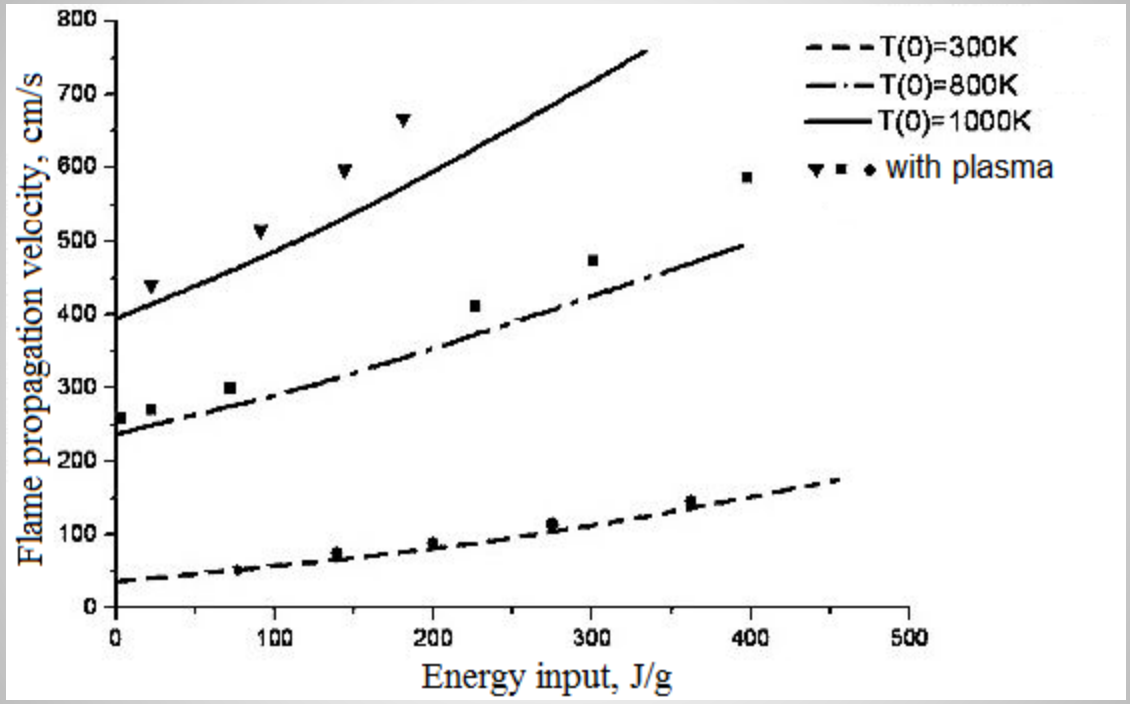

Flame propagation velocity and input energy.

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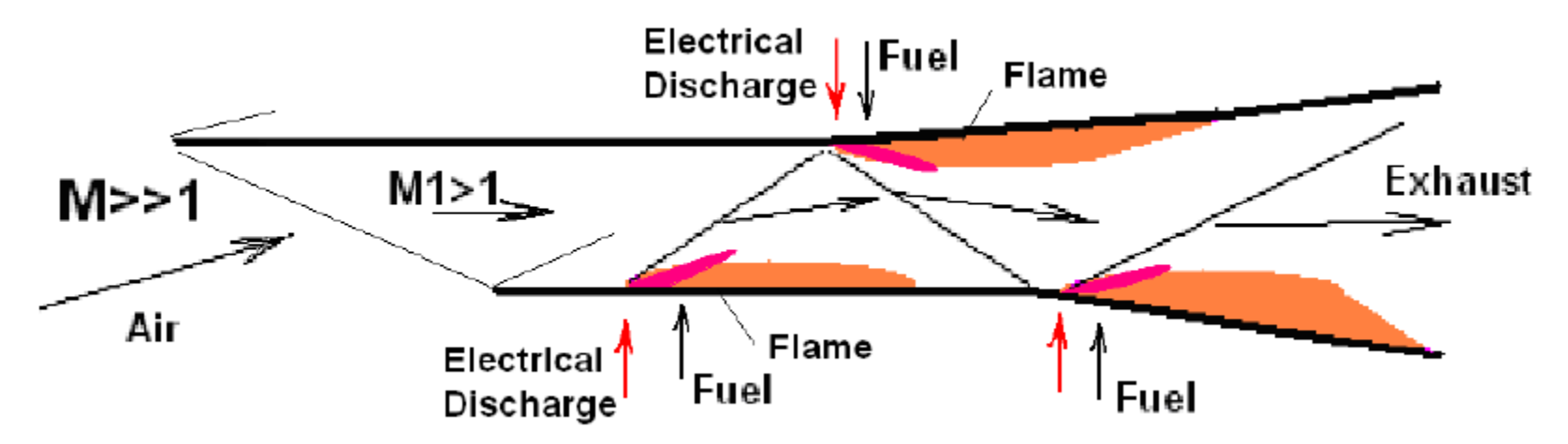

Multiple local plasma formation impact on the processes in scramjet

Goals:

- scramjet may be used at several values outside of parameters
- more effective design may be used
- noise reducing
- etc

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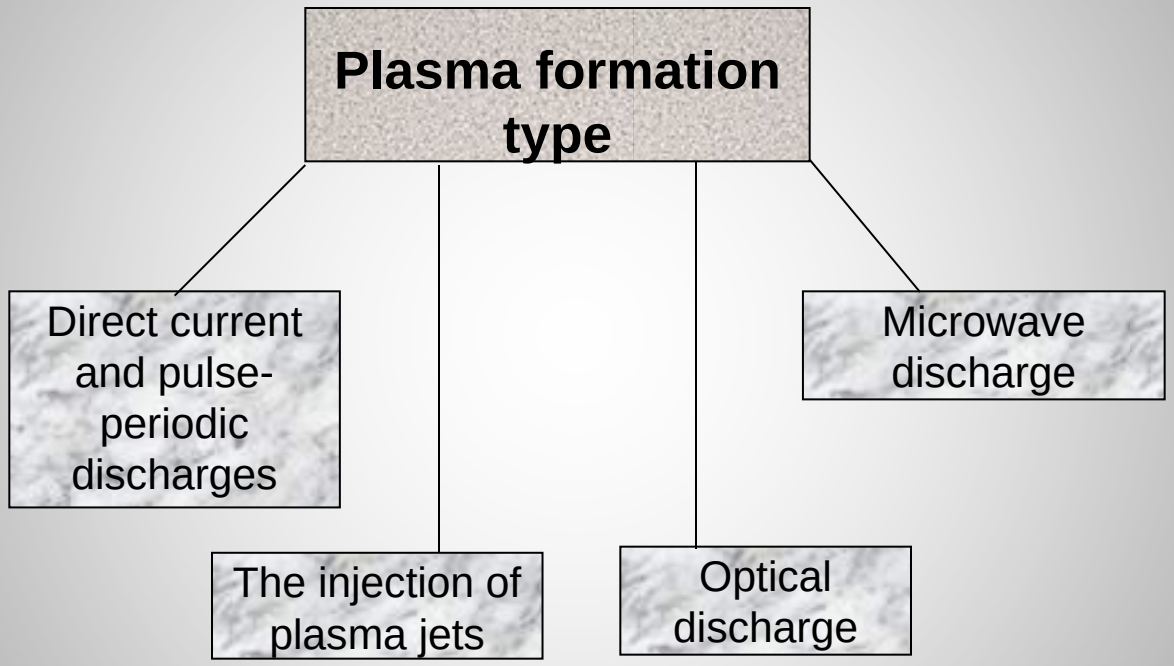

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Some researchers believe is not an effective use of plasma formations in combustion applications due to size of generators, complexity of the jet design, and small efficiency coefficient … but this is a matter of time only

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Thank you for you attention.