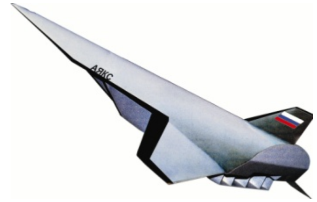


CALCULATION OF THE HEAT-SHIELDING OF THE CHAMBER OF COMBUSTION BY MEANS OF THE VEIL

A.L. Kuranov, A.M. Mikhailov

Hypersonic Systems Research Institute
St. Petersburg

IX International Workshop
“Thermochemical processes in plasma aerodynamics”
St.Petersburg, 2 -6 July 2012

INTRODUCTION

Among the technologies developed for hyper sound flights, methods of a heat-shielding are one of the most important. The impossibility of use of methods traditional for spacecrafts is caused by need of long flight for dense beds of the atmosphere.

For the calculation of the heat-shielding of the chamber of combustion by means of the veil as cooling liquids water, T1 kerosene, kerosene and water mixes were considered.

Although the boundary layer there is a gradual mixing and chemical interaction with the core coolant flow of the reaction products, the comparative cost calculations of heat for heating fluids, filed with the veil, has been assumed that:

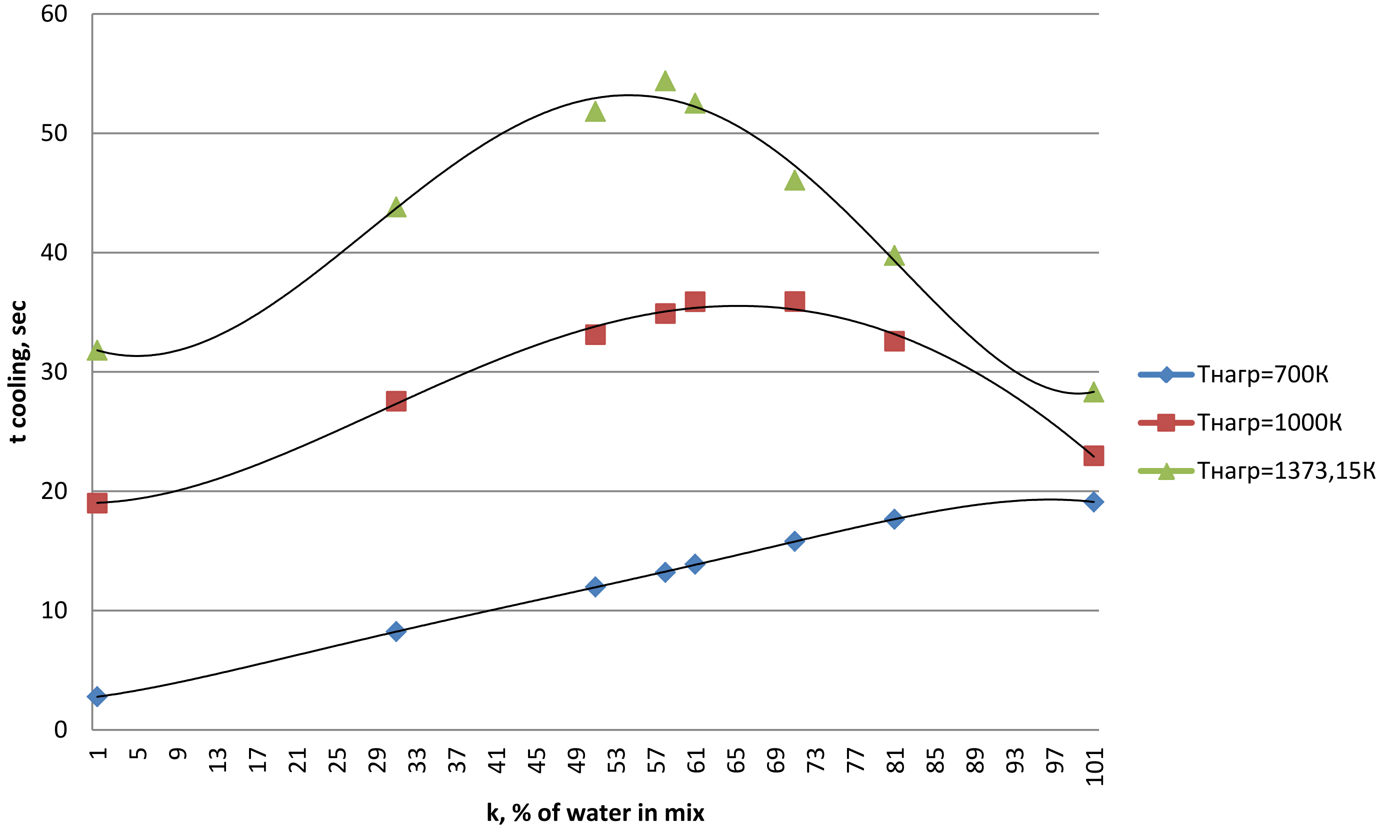
-The curtain is not mixed with the main flow of combustion products

-Heating, evaporation and decomposition of the material of the veil is due to the heat given out the core flow.

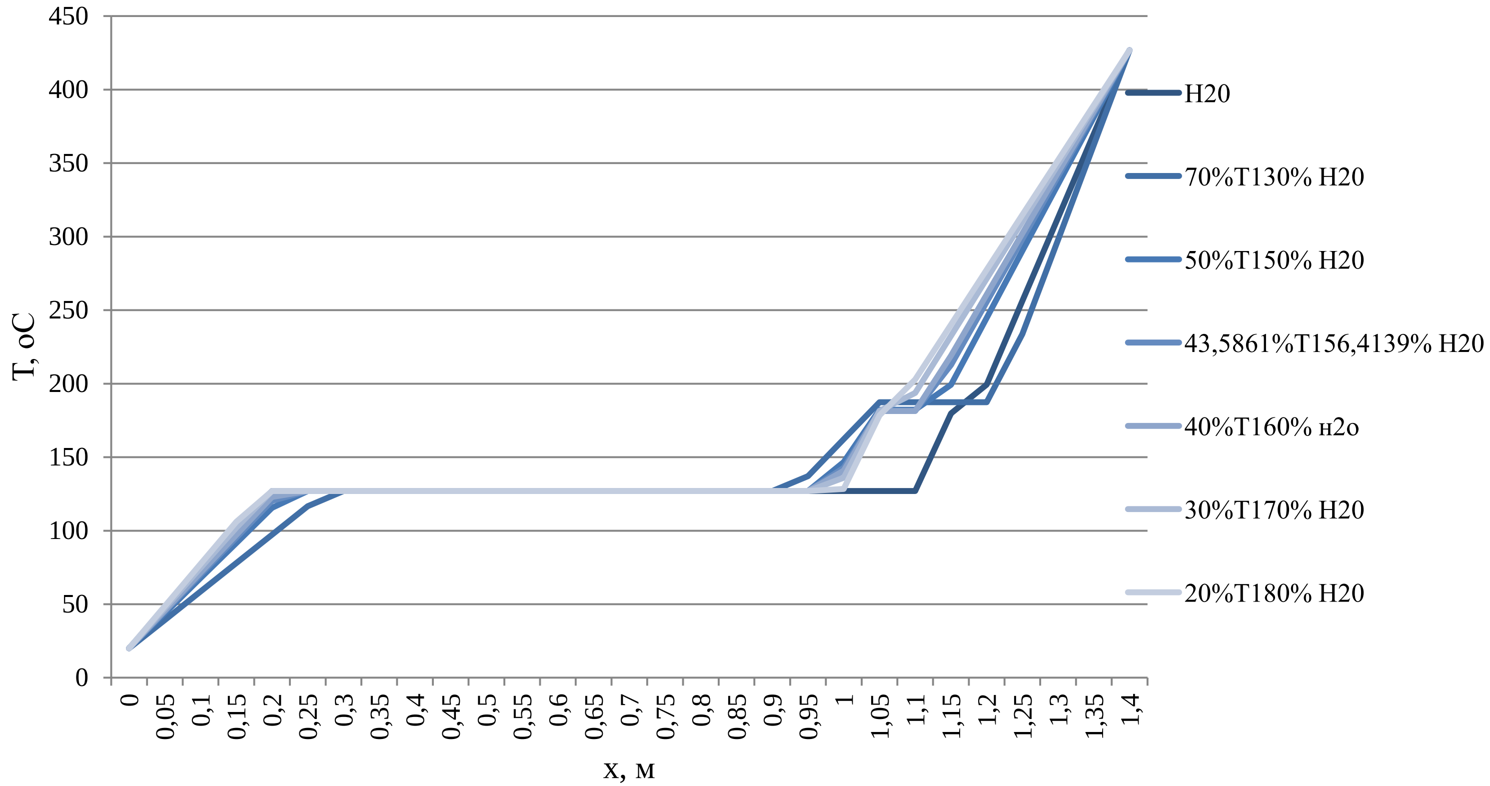
The energy for heating and decomposition of the coolant, depending on the heating temperature

NN п/п	Завеса	Тнагр=700К		Тнагр=1000К		Тнагр=1373,15К	
		$X_{H_2}/X_{ств}$	ΔH	$X_{H_2}/X_{ств}$	ΔH	Хнг/Хств	ΔH
1	H_20	**o 0**	**3251**,7	**0 0**	**3910,6**	**0,0000424 0**	**4818,4**
2	T1	0.09322 0,52429	472,5	0,40443 0,51596	3236,3	0,48014 0,51393	5415,3
3	70%T130% H_20	0,09623 0,37801	1401,7	0,44548 0,33306	4689,7	0,55487 0,29292	7461,1
4	50%T150% H_20	0,10345 0,22429	2039,5	0.49404 0,15485	5638,0	0,62606 0,08190	8823,6
5	43,5861%T156,413 9% H_20	0,10696 0,16000	2246,6	0,51449 0,08307	5940,1	**0,65450 0**	**9258,1**
6	40%T160% H_2O	0,10925 0,11986	2362,9	0.52722 0,03890	6108,7	**0,63618 0**	**8939,9**
7	30%T170% H_20	**0,11749 0**	**2688,7**	**0,53574 0**	**6111,7**	**0,55496 0**	**7842,8**
8	20%T180% H_20	**0,126821 0**	**3005,9**	**0,46874 0**	**5544,9**	**0,44238 0**	**6768,3**

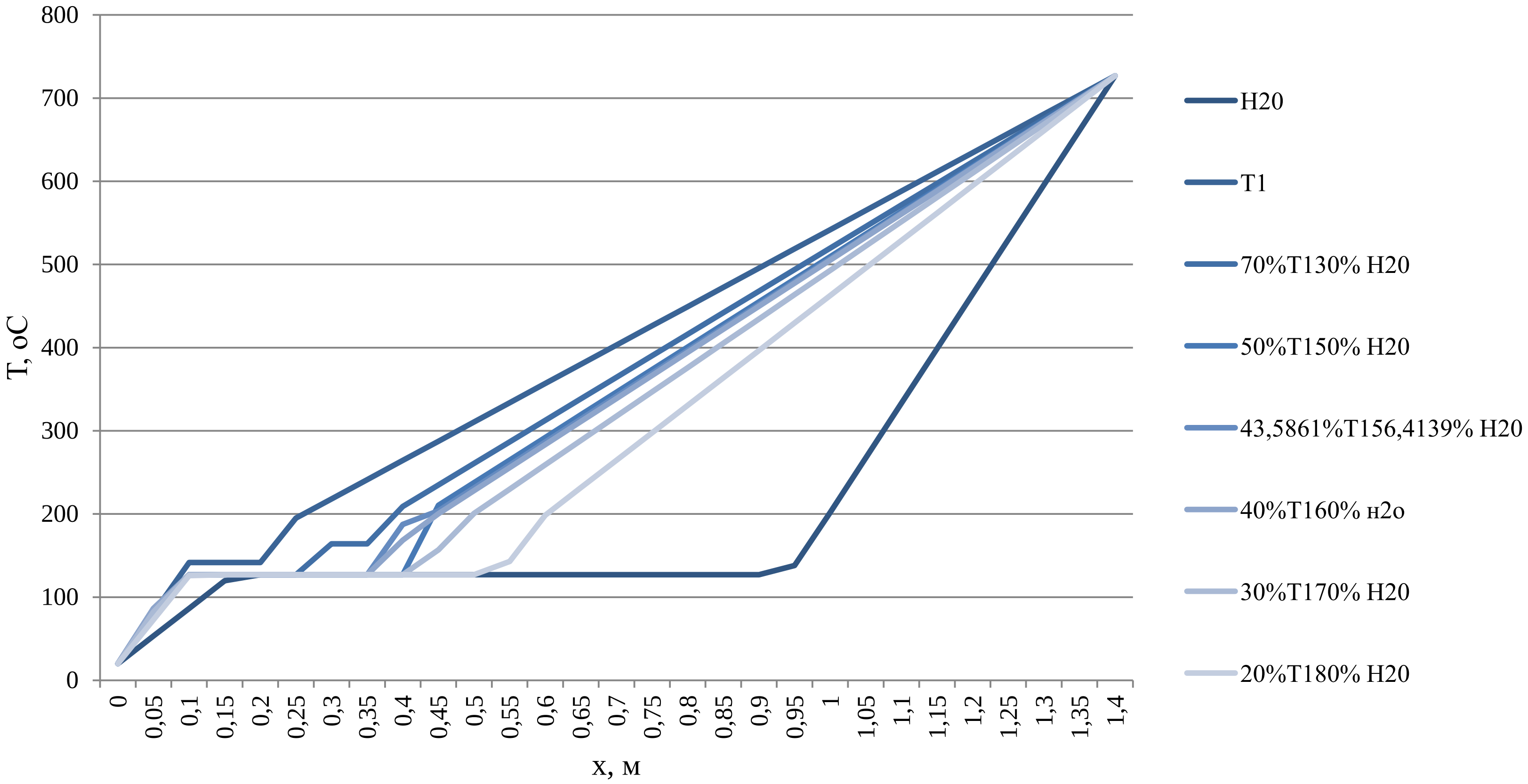
A plot of the effective time of the heat protection ratio of the components by heating to 700K, 1000K, and 1373.15 K for the length of the cooling COP of 1.4 m



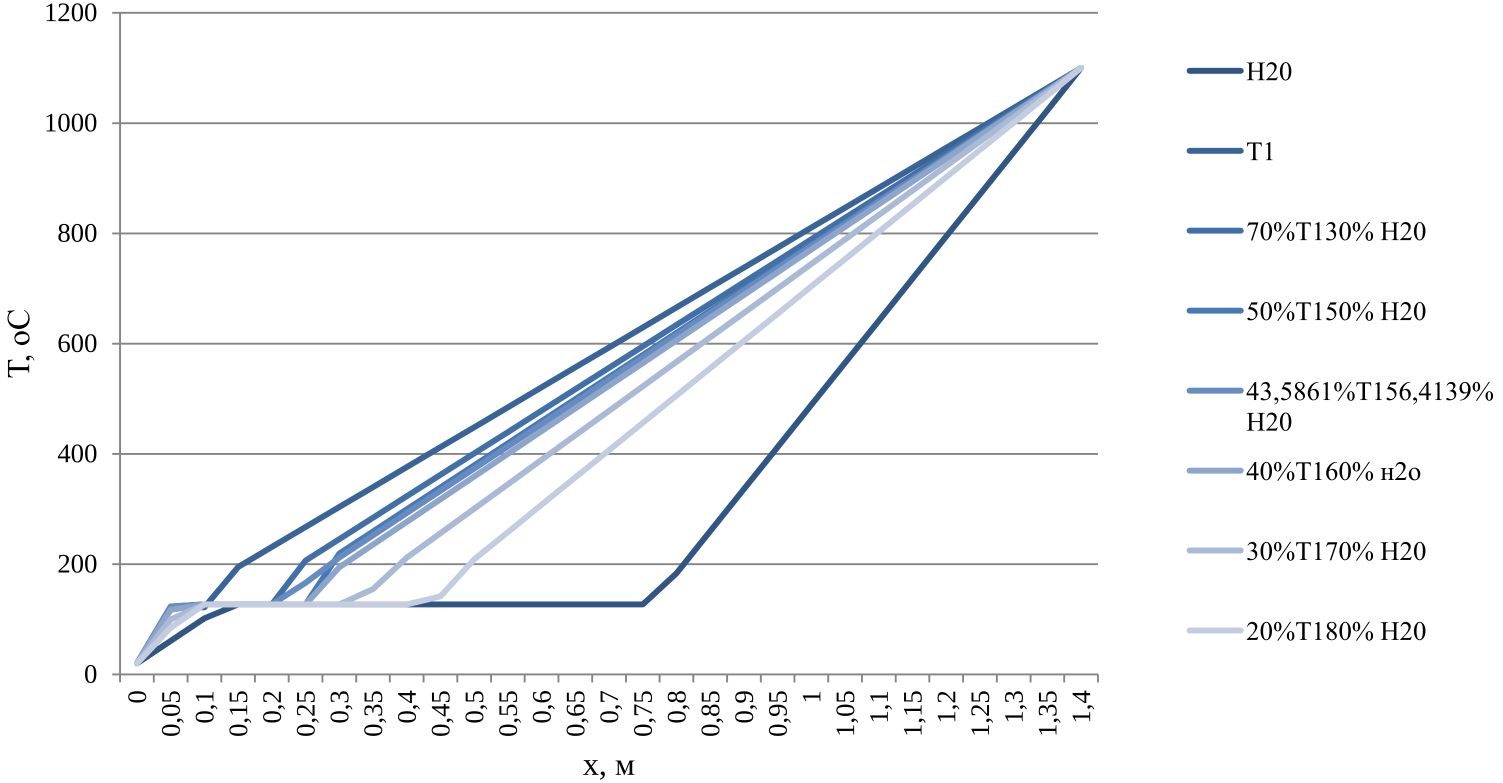
The graph of the temperature distribution along the length of the COP in Tmax = 700K

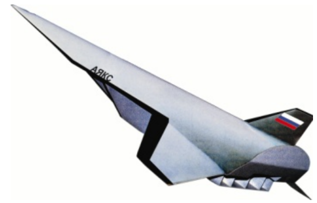


The graph of the temperature distribution along the length of the COP in Tmax = 1000K



The graph of the temperature distribution along the length of the COP in Tmax = 1373.15 K





Temperature changes in the plots are obtained in different ways. On the ground due to the constant heat flow and slightly changing the temperature increases the thermal conductivity components evenly. In the second part of the growth temperature is constrained latent heat of vaporization of water. The third is also observed uniform growth. The fourth section has a more moderate growth due to different boiling point fractions of petroleum. Note that the length of the liquid phase was calculated to exclude heat removal of the gaseous phase. Thus, they are the asymptotes of the temperature profiles.

For a more accurate calculation is necessary to have information about the composition of the incoming flow, the nature of heat transfer, the method and nature of mixing kerosene and water, the heat of the combustion chamber wall. The obtained thermodynamic evaluation allow us to estimate the optimal composition of mixtures of water and kerosene T1 on heating to different temperatures. Determination of the temperature distribution along the length of the cooled section gives an indication of the character taking place processes in each zone