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NASA-GLENN CHEMICAL EQUILIBRIUM PROGRAM CEA2, MAY 21, 2004
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 REFS: NASA RP-1311, PART I, 1994 AND NASA RP-1311, PART II, 1996

problem

rocket fac ac/at=3.0 tcest,k=3800
 p,bar=100,
 sup,ae/at=10,40,160,640,2560,
 react
 name=H2 moles=1.0 t,k=298.15
 name=O2 moles=0.5 t,k=298.15
 end

OPTIONS: TP=F HP=F SP=F TV=F UV=F SV=F DETN=F SHOCK=F REFL=F INCD=F
 RKT=T FROZ=F EQL=T IONS=F SIUNIT=T DEBUGF=F SHKDBG=F DETDBG=F TRNSPT=F

TRACE= 0.00E+00 S/R= 0.000000E+00 H/R= 0.000000E+00 U/R= 0.000000E+00

Pc,BAR = 100.000000

Pc/P =

SUBSONIC AREA RATIOS =

SUPERSONIC AREA RATIOS = 10.0000 40.0000 160.0000 640.0000 2560.0000

NFZ= 1 Mdot/Ac= 0.000000E+00 Ac/At= 3.000000E+00

REACTANT	MOLES	(ENERGY/R),K	TEMP,K	DENSITY
EXPLODED FORMULA				
N: H2	1.000000	-0.326752E-06	298.15	0.0000
H	2.00000			
N: O2	0.500000	-0.154035E-05	298.15	0.0000
O	2.00000			

SPECIES BEING CONSIDERED IN THIS SYSTEM
 (CONDENSED PHASE MAY HAVE NAME LISTED SEVERAL TIMES)
 LAST thermo.inp UPDATE: 9/09/04

g 6/97 *H	g 4/02 HO2	tpis78 *H2
g 8/89 H2O	g 6/99 H2O2	g 5/97 *O
g 4/02 *OH	tpis89 *O2	g 8/01 O3
g11/99 H2O(cr)	g 8/01 H2O(L)	g 8/01 H2O(L)

O/F = 0.000000

ENTHALPY	EFFECTIVE FUEL	EFFECTIVE OXIDANT	MIXTURE
(KG-MOL)(K)/KG	h(2)/R	h(1)/R	h0/R
	-0.60888815E-07	0.00000000E+00	-0.60888815E-07

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KG-FORM.WT./KG	bi(2)	bi(1)	b0i
*H	0.11101687E+00	0.00000000E+00	0.11101687E+00
*O	0.55508435E-01	0.00000000E+00	0.55508435E-01

POINT ITN	T	H	O
1 8	3730.278	-9.575	-14.967
2 2	3723.353	-9.593	-14.984
Pinf/Pt = 1.730122			
3 3	3542.876	-9.813	-15.178
Pinf/Pt = 1.727754			
3 2	3543.310	-9.812	-15.178
4 2	3716.555	-9.601	-14.991
4 2	3715.486	-9.602	-14.992
4 2	3715.394	-9.602	-14.992
2 2	3726.907	-9.584	-14.976
Pinf/Pt = 1.730186			
3 3	3546.007	-9.804	-15.170
Pinf/Pt = 1.727819			
3 2	3546.443	-9.803	-15.169
4 2	3720.093	-9.592	-14.983
4 2	3719.022	-9.593	-14.984
4 2	3718.930	-9.593	-14.984
END OF CHAMBER ITERATIONS			
4 5	2536.289	-11.567	-16.767
4 3	2580.779	-11.467	-16.674
4 2	2580.903	-11.466	-16.674
5 4	2172.499	-12.485	-17.616
5 2	2179.814	-12.465	-17.598
6 4	1765.610	-13.772	-18.822
6 2	1755.873	-13.808	-18.856
7 4	1311.560	-15.914	-20.866
7 2	1315.392	-15.890	-20.844
8 3	939.059	-19.075	-23.954
8 2	933.044	-19.146	-24.024

THEORETICAL ROCKET PERFORMANCE ASSUMING EQUILIBRIUM

COMPOSITION DURING EXPANSION FROM FINITE AREA COMBUSTOR

Pin = 1450.4 PSIA
 Ac/At = 3.0000 Pinj/Pinf = 1.022603
 CASE =

	REACTANT	MOLES	ENERGY	TEMP
			KJ/KG-MOL	K
NAME	H2	1.0000000	0.000	298.150
NAME	O2	0.5000000	0.000	298.150

O/F= 0.00000 %FUEL= 0.000000 R,EQ.RATIO= 1.000000 PHI,EQ.RATIO= 0.000000

	INJECTOR	COMB END	THROAT	EXIT	EXIT	EXIT	EXIT	EXIT
Pinj/P	1.0000	1.0468	1.7669	65.691	362.76	1983.69	11249.0	65967.7
P, BAR	100.00	95.533	56.597	1.5223	0.27567	0.05041	0.00889	0.00152

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T, K	3730.28	3718.93	3546.44	2580.90	2179.81	1755.87	1315.39	933.04
RHO, KG/CU M	5.1130 0	4.9007 0	3.0842 0	1.2304-1	2.7020-2	6.2065-3	1.4642-3	3.5202-4
H, KJ/KG	0.00000	-45.579	-1035.77	-6508.45	-8434.52	-9991.28	-11219.8	-12131.8
U, KJ/KG	-1955.80	-1994.96	-2870.84	-7745.72	-9454.76	-10803.5	-11826.9	-12562.4
G, KJ/KG	-58737.3	-58647.8	-56920.0	-47177.8	-42783.6	-37660.0	-31947.5	-26834.6
S, KJ/(KG)(K)	15.7461	15.7578	15.7578	15.7578	15.7578	15.7578	15.7578	15.7578
M, (1/n)	15.858	15.862	16.069	17.344	17.764	17.974	18.014	18.015
(dLV/dLP)t	-1.04715	-1.04708	-1.04248	-1.01396	-1.00498	-1.00078	-1.00003	-1.00000
(dLV/dLT)p	1.7849	1.7862	1.7446	1.3386	1.1432	1.0276	1.0012	1.0000
Cp, KJ/(KG)(K)	10.1792	10.2076	10.0551	7.0314	4.8842	3.2212	2.5379	2.2440
GAMMAS	1.1324	1.1322	1.1289	1.1213	1.1367	1.1777	1.2229	1.2589
SON VEL,M/SEC	1488.2	1485.6	1439.3	1177.9	1076.9	978.0	861.7	736.3
MACH NUMBER	0.000	0.203	1.000	3.063	3.814	4.571	5.498	6.690

PERFORMANCE PARAMETERS

Ae/At	3.0001	1.0000	10.000	40.000	160.00	640.00	2560.00
CSTAR, M/SEC	2203.0	2203.0	2203.0	2203.0	2203.0	2203.0	2203.0
CF	0.1371	0.6533	1.6378	1.8644	2.0292	2.1503	2.2360
Ivac, M/SEC	6758.5	2714.3	3950.8	4355.6	4651.9	4865.2	5013.2
Isp, M/SEC	301.9	1439.3	3607.9	4107.2	4470.2	4737.0	4925.8

MOLE FRACTIONS

*H	0.03354	0.03351	0.02917	0.00632	0.00137	0.00007	0.00000	0.00000
HO2	0.00027	0.00026	0.00018	0.00001	0.00000	0.00000	0.00000	0.00000
*H2	0.12070	0.12052	0.11189	0.04814	0.02053	0.00386	0.00015	0.00000
H2O	0.68966	0.69025	0.71805	0.89677	0.96001	0.99323	0.99976	1.00000
H2O2	0.00005	0.00005	0.00003	0.00000	0.00000	0.00000	0.00000	0.00000
*O	0.01572	0.01568	0.01331	0.00226	0.00040	0.00001	0.00000	0.00000
*OH	0.10590	0.10552	0.09457	0.02931	0.00970	0.00119	0.00002	0.00000
*O2	0.03417	0.03419	0.03278	0.01718	0.00798	0.00164	0.00007	0.00000

* THERMODYNAMIC PROPERTIES FITTED TO 20000.K

PRODUCTS WHICH WERE CONSIDERED BUT WHOSE MOLE FRACTIONS
WERE LESS THAN 5.000000E-06 FOR ALL ASSIGNED CONDITIONS

O3	H2O(cr)	H2O(L)
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