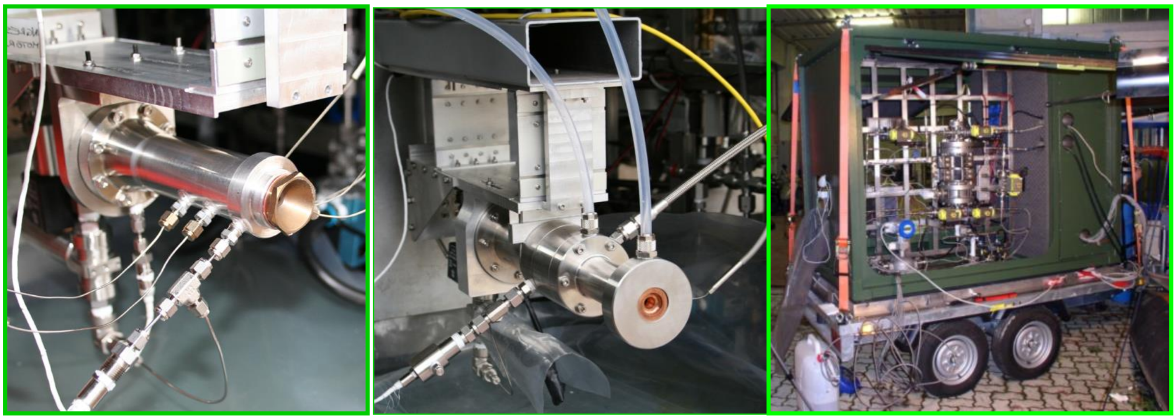
SITAEL

Green Propellant Rockets

Since 2006, SITAEL is active in the development and test of small “green” monopropellant (H_2O_2) and bi-propellant (H_2O_2-Hydrocarbons) rockets for spacecraft and missile reaction control systems (target range: 1-40 N monoprop, 20-100 N bi-prop).

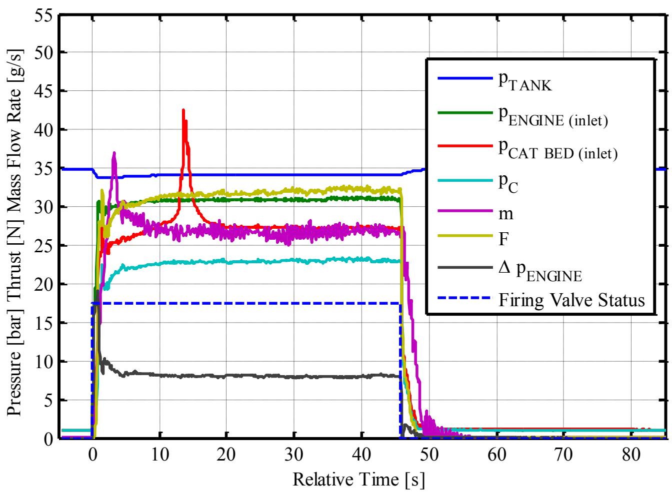
Temperature and characteristic velocity efficiencies up to 98%.



Pictures of the monopropellant thruster prototype (left), the bipropellant one (mid) and SITAEL’s Green Propellant Rocket Test Facility

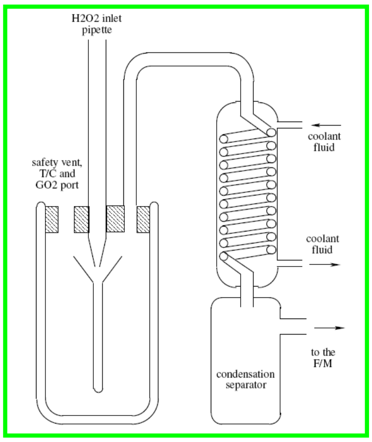
SITAEL’s **Green Propellant Rocket Test Facility** is highly instrumented. During a typical firing the following measurements are recorded:

- hydrogen peroxide tank delivery pressure;
- hydrogen peroxide tank temperature;
- cavitating Venturi differential pressure;
- cavitating Venturi outlet pressure;
- hydrogen peroxide mass flow rate;
- fuel tank delivery pressure;
- fuel temperature before the flowmeter;
- fuel mass inside the tank;
- fuel mass flow rate;
- fuel injection pressure;
- coolant tank temperature;
- coolant pressure;
- coolant mass flow rate;
- exhaust coolant temperature;
- differential pressure across the catalytic bed;
- absolute pressure after the catalytic bed;
- temperature of the hydrogen peroxide decomposition products;
- five temperatures along the catalytic bed;
- pre-heating temperature of the catalytic bed.



A typical firing of the monopropellant thruster (using 91.1% H_2O_2) and LR-III-106 Pt/α-Al_2O_3 catalyst

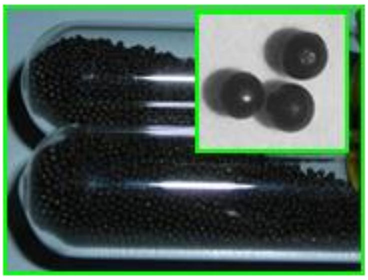
Development and testing of advanced catalysts for hydrogen peroxide decomposition

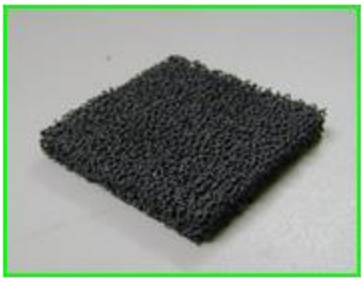


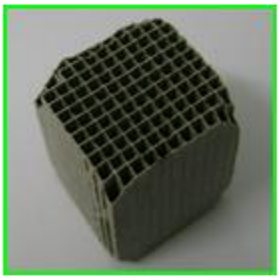
A schematic drawing (left) and a picture (mid) of SITAEL's test bench for the characterization of the catalysts. Picture of the main bottle of the test bench during the decomposition reaction (right)

I.C.	Catalyst	Support	BET Surface Area [m^2/g]	MPD Å	Nominal metal load (wt%)	η_{c*}/ $\eta_{\Delta T}$	Endurance (p_c=15 bar, 90% HTP, G=11.8 kg/s m^2)
LR-III-97	*Pt/α–Al_2O_3*	*0.6/4 by SASOL*	4	400	2	>90%/>90%	750 s
LR-III-106	*Pt/α–Al_2O_3*	*0.6/4 by SASOL*	4	400	1	>95%/>95%	2500 s
LR-IV-11	*Pt/θ–α–Al_2O_3*	*0.6/75 by SASOL*	75	105	1	>90%/>95%	1100 s
CZ-11-600	*Pt/$Ce_{0.6}Zr_{0.4}O_2$/Al_2O_3*	*0.6/75 by SASOL*	75	105	10	>95%/>95%	2000 s

Main features of four different catalysts for H2O2 decomposition developed by SITAEL







Silver grids, alumina pellets, carborundum foam and cordierite honeycomb catalysts developed by SITAEL

SITAEL S.P.A | Via San Sabino, 21 - 70042 Mola di Bari (BA) Italy | info@sitael.com | www.sitael.com