

ARGAL reactor 2 tests

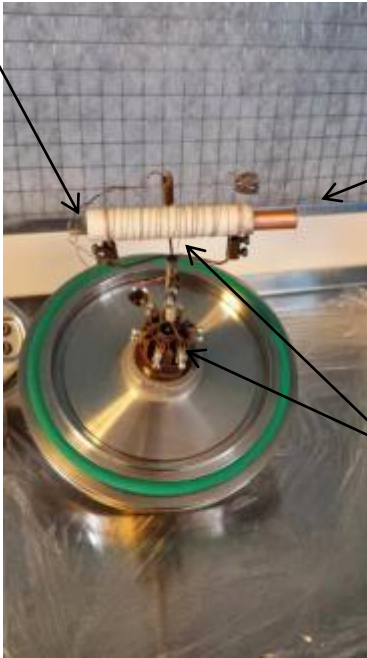
Metal & metal hydride micro
particles mix

By U. Mastromatteo, ARGAL lab, october – december 2015



Reactor 2 description

Pt 100 probe



Copper capsule containing the mix

Internal side of the bottom closure showing feedthroughs, ceramic tube with heater wire



SS capsule containing the mix ("hermetic")

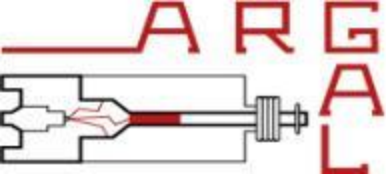
Gas inlet, vacuum and pressure sensor

2 liters SS chamber

Bottom closure

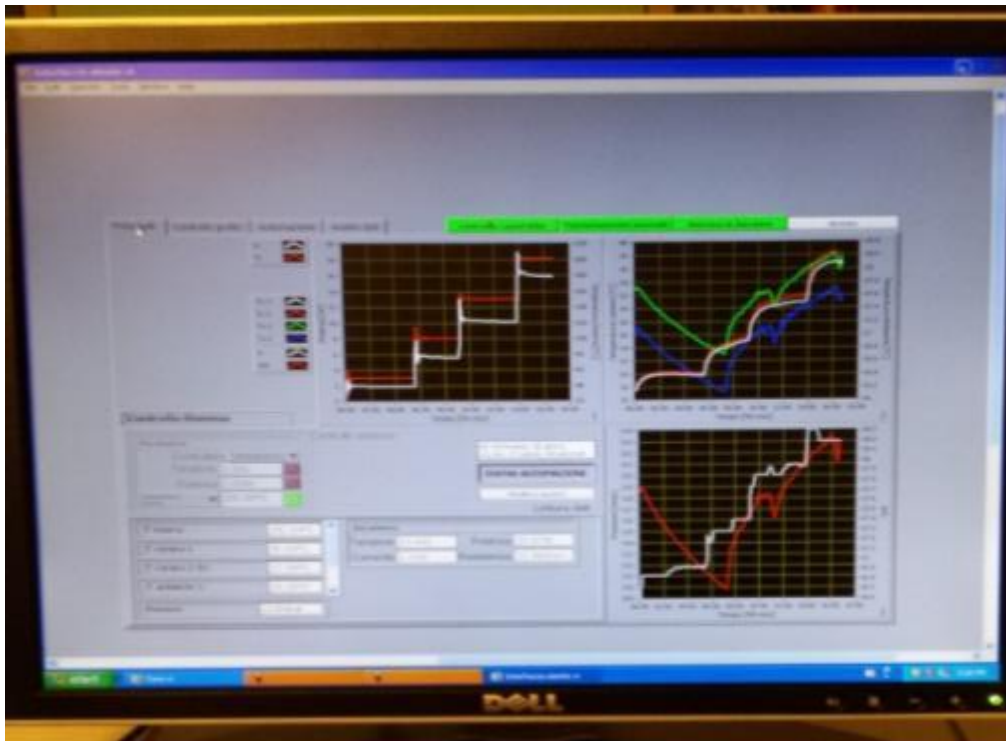
Ambient temperature probe





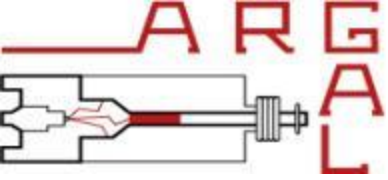
Controlling the reactor

Typical screenshot of Lab View controlling program. The test is usually conducted increasing the input power by steps. It is possible to control the system with constant power input, constant internal temperature or constant supply voltage.



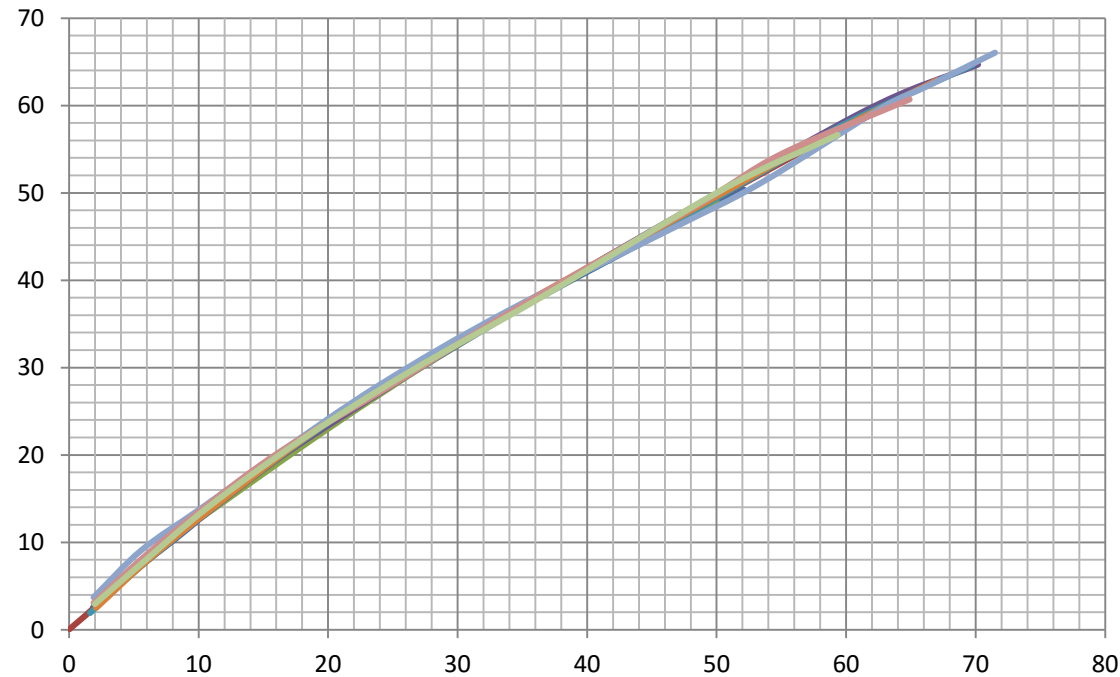
The chamber temperature (T_c) is the parameter used to sense extra power

In the left window P_{in} (white) and T_i (red). In the right window T_c (red) and T_a (green). In the bottom window the Pressure (white) and T_a again (red)

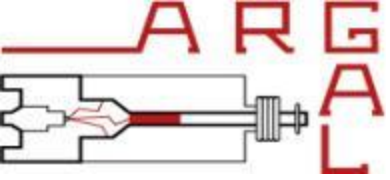


Tests comparison

Press. mbar	Pin (W)	Tc (C)	Ta (C)	Ti (C)	Tc-Ta	Rth (C/W)	Pi/Po
105	1,83	21,2	18,65	50	2,55	1,393443	1
114	5,1	25,4	18,6	100	6,8	1,333333	1,085714
125	9,2	30,1	18,5	150	11,6	1,26087	1,190476
131	14,7	36,9	18,42	204	18,48	1,257143	1,247619
137	20,3	42,8	19,1	251	23,7	1,167488	1,304762
146	28	50	19,25	304	30,75	1,098214	1,390476
156	37	58	19,45	354	38,55	1,041892	1,485714
174	52,1	69,85	19,49	405	50,36	0,966603	1,657143

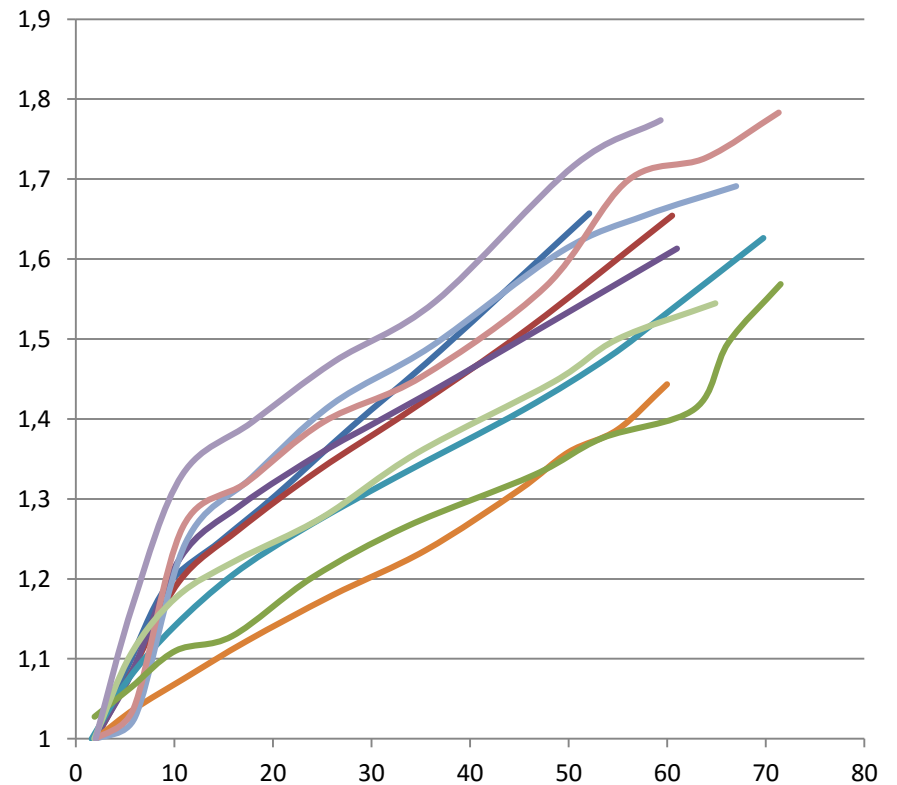
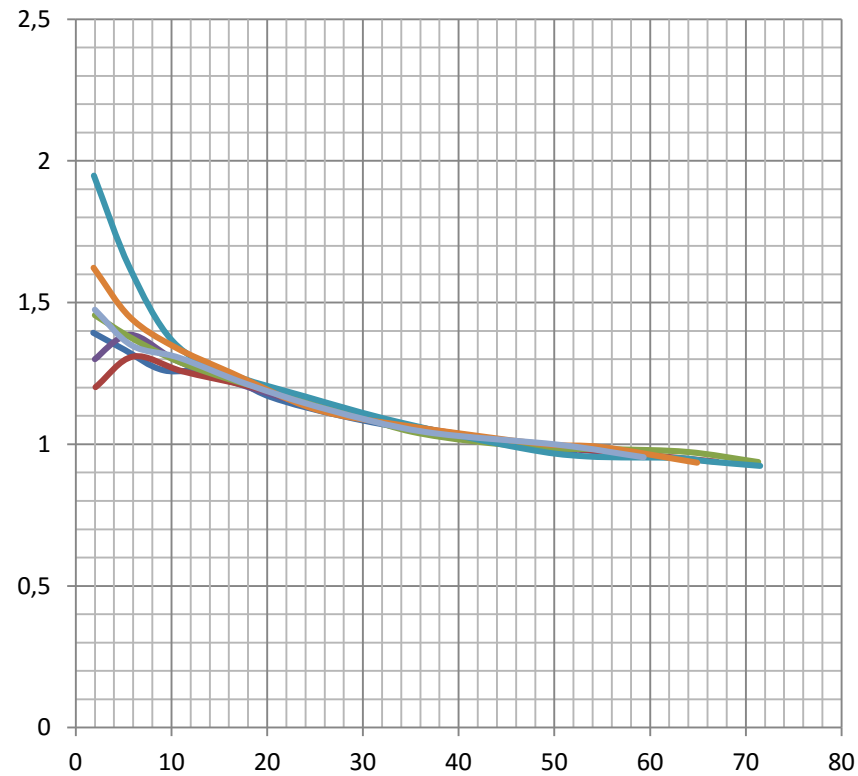


Above a typical table with data at the steady state (after 3, 4 hours each step). Below the comparison between 8 different test (including calibration without any mix). The overlapping of the curves shows the good repeatability of the reactor, but unfortunately no extra power. On the X axis is the Pin and on the Y axis Tc-Ta



Trend of Pressure and Rth

On the X axis again Pin and for the left graph Rth on the Y axis; normalized pressure P_i/P_o on the Y axis in the right graph. The Rth curves confirm the repeatability of the reactor, while the pressure curves show increase of the reactor pressure due to the release of Hydrogen from the mix hydride from the capsule not perfectly hermetic. The only test without anomalous pressure increase are the calibration ones.





Comments

- It is possible to prepare the reactor 2 for a test in a very short time after having the capsule containing the mix ready (half an hour).
- The extra power missing we think was due to the hydrogen lost from the capsule at quite low temperature (between 50 and 100 degrees): bad sealing.
- The starting pressure of the chamber was around 100 mbar, while in the capsule should reach easily 100 bar if sealed correctly.
- We are preparing SS capsule well sealed (disposable) in order to repeat the tests done and also with new powder mixtures.