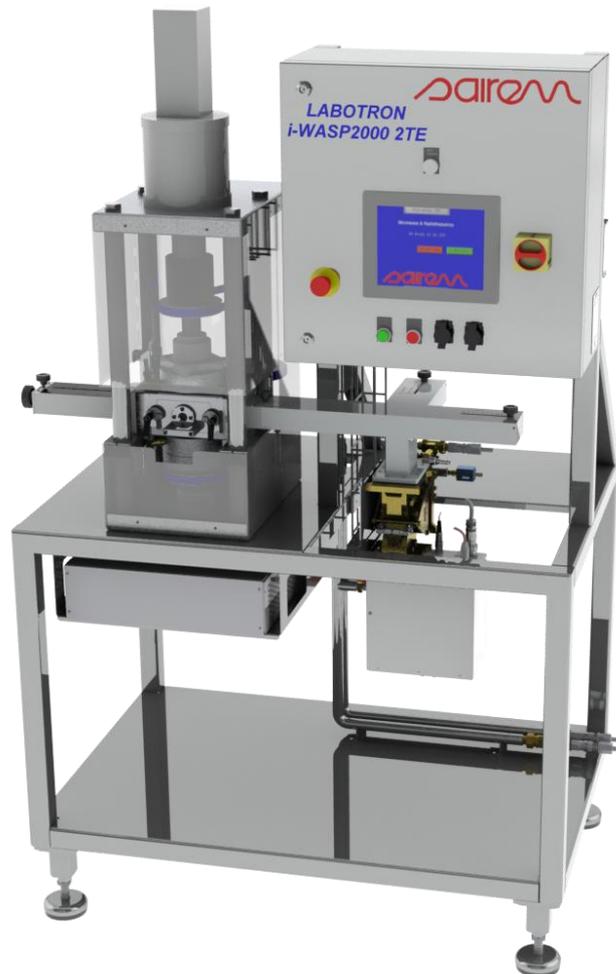




INTEGRATED MICROWAVE-ASSISTED PRESS

LABOTRON™ *i*-WASP2000



The Labotron™ *i*-WASP2000 consists of a monomode microwave cavity integrated with a 16000 N press; this equipment has been designed for studies related to the behaviour of composite materials with a ceramic or metallic matrix with applications in sintering of metallic powders, alumina or other ceramics. The equipment can be used equally in laboratory and industry.

The unique performance of the Labotron *i*-WASP 2000 is related to the following main parameters:

- Microwave heating using a TE₀₁₃ (for dielectric material) or TE₀₁₄ (for magnetic material) monomode cavity
- Microwave power adjustable from 0 to 2000 W (10 W increment);
- Temperature measurement and control via infra-red thermometer;
- High uniformity of heating due to the possibility to work with small volumes of samples;
- Compressive force directly on the sample up to 16 000 N, adjustable during microwave treatment;
- Possibility to revolve the sample during the treatment to get higher homogeneity of the heating;
- Gas tight microwave cavity giving the possibility to treat at low pressure or under controlled atmosphere;
- Steps of time independently for pressure and for MW power.

In addition, the microwave generator allows treatment both in continuous wave (CW) and controlled pulse giving the possibility to compare test results at the same average power and to see if there could be any special effect related to the interaction between the microwave energy and the material to be treated.

Ref.	LABOTRON™ i-WASP2000
Microwave cavity	Monomode cavity TE ₀₁₃ or TE ₀₁₄ , made out of aluminium alloy, vacuum gas tight, water cooled, front access door with sight glass, during treatment sample rotation, controlled compression force by electric system. The whole system is mounted on chassis with adjustable feet – for dimensions see enclosed drawings; total weight 220 kg.
Sample	Max. dimensions including crucible & thermal insulation: H = 40 mm, diam. 35 mm; Crucible & thermal insulation are not provided; Shape: as in a standard operation the sample revolves around the vertical axis, a sample with cylindrical shape is recommended.
Final temperature of the sample	When the microwave power is applied, the sample increases its temperature depending on its specific heat (Cp). A stable temperature is reached when the thermal loss (by conduction and thermal radiation) equals the applied microwave power. The max. temperature is limited by the material interface (alumina) between the load and the stainless steel actuator of the press.
Temperature (T) increase ratio	Considering 2 kW of microwave power absorbed by the sample (0 W reflected power), the temperature increase will be ~ 20 °C/s for 50 g sample having an average Cp = 2 Jg ⁻¹ K ⁻¹ before the heat transfer by conduction and thermal radiation slows down the temperature increase. (P = m*Cp*ΔT/t).
Temperature measurement & control	Located at the rear of the microwave cavity; IR pyrometer 200 - 1200 °C (other temperature ranges on demand); Control of temperature and programming by levels of temperature vs. time, power vs. time.
Press	Compression adjustable from 700 N to 16 000 N, i.e. 0.55 MPa to 12.5 MPa for 40 mm diameter; pressure adjustment via HMI (touch screen), precision +/- 1 % at 10 000 N, piston course 20 mm, piston speed 1 cm/s.
Vacuum usage	Primary vacuum 1 mbar, vacuum pump connexion via DN25 flange at the rear (pump not provided); Cavity can be also used for applications carried out in controlled inert atmosphere, oxidation, reducing, partial pressure of water vapour etc. O-rings: Viton.
Microwave generator	GMP20KIP, 2.45 GHz, microwave power adjustable from 0 W to 2000 W with 10 W increment; Operation: continuous wave (CW) or pulses; Switching mode power supply with low ripple to decrease the risk of arcs when running high electric field in an application at low pressure and high temperature.
Sample revolution	0.1 rev/s, 24 VDC motor. The rotation can be turned ON and OFF during the microwave treatment using the touch screen HMI.
Gas fittings (inlets/outlets)	2 off, 3/8 G; manometer and safety release pressure valve
HMI	Colour touch screen 7.5" (IP65) Data recording and export in CSV files via USB port , Ethernet port Main parameters available on and screen set-up: steps of time for forward power, reflected power (W) measurement, steps of time for compression force (t), temperature (°C), time (s), MW operation mode (CW or pulsed)
Impedance tuning	With manual adjustable iris and sliding short circuit to adjust resonance mode between TE ₀₁₃ (dielectric sample) & TE ₀₁₄ (magnetic sample). Te hybrid manual tuner.
Personnel security	Safety interlock and relays connected to the microwave generator; Warning flashing on the HMI if the temperature of the sample is higher than the minimum value measured by the IR thermometer when the cavity door is opened.
Cooling	By water for the microwave generator, min 3 L/min (for cca. 3 kW of heat to be dissipated), Δp = min. 3 bar, T _{water} = 18 – 25 °C, fast release connectors for water in/out
Mains	3 x 400 V + earth, 4 kVA at maximum power

