



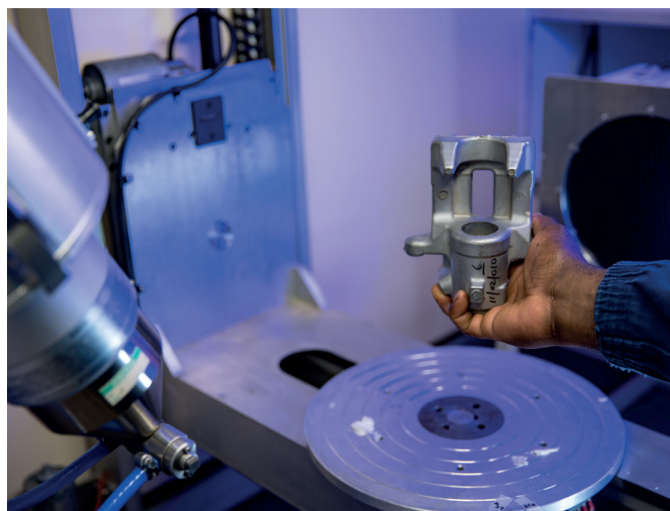
science, technology
& innovation

Department:
Science, Technology and Innovation
REPUBLIC OF SOUTH AFRICA



HOT ISOSTATIC PRESSING

FOR IMPROVED MATERIAL PERFORMANCE



Hot Isostatic Pressing (HIP) is a specialised manufacturing process employed in industrial sectors to eliminate internal defects in components that occur during the initial manufacturing process. This is achieved by subjecting components to a blend of high temperature and high gas pressure (approx. 2000 bar) within a regulated environment

The CSIR houses state-of-the-art HIP technology with the ability to perform HIPing, quenching, and heat treatment in one cycle. This integrated approach results in **reduced costs** and **increased productivity**. The facility's operations are supported by specialised non-destructive testing (NDT) and metrology laboratories that uphold standards of quality and precision.



APPLICATIONS

- Casting densification
- Additive manufacturing
- Powder metallurgy
- Metal injection moulding
- Introduce compressive residual stresses in parts to improve fatigue performance.

MATERIALS

- Steel
- Titanium

- Aluminium
- Magnesium
- Nickel superalloys.

INDUSTRIES

- Aerospace
- Automotive
- Mining
- Industrial
- Oil and gas
- Power generation.

TECHNOLOGY EQUIPMENT SPECIFICATIONS

Each component of the HIP is integral to ensuring the process's versatility and success.

	PRESS TYPE	QIH 32 MOLYBDENUM RAPID COOLING FURNACE
	Maximum operating pressure	207 MPa
	Maximum operating temperature	1 400 °C
	Maximum height of workload	890 mm
	Maximum diameter of workload	300 mm
	Design pressure	228 MPa
	Pressure vessel volume	242 dm ³
	Maximum weight of workload	350 kg
	Temperature control	± 8 °C
	Number of heating zones	3 pcs
	Number of furnace thermocouples per heating zone, type B	2 pcs
	High quench capability for in situ heat treatment	

	PRESS TYPE	QIH 32 MOLYBDENUM RAPID QUENCHING FURNACE
	Maximum operating pressure	207 MPa
	Maximum operating temperature	1 400 °C
	Maximum height of workload	500 mm
	Maximum diameter of workload	270 mm

Pre-HIPing assessments and measurements are crucial for establishing a material's initial condition. These include density measurement, dimensional analysis and mechanical property testing. Metrological analysis such as surface profilometry provide high-resolution data for analysing surface finish and geometrical accuracy.

METROLOGY EQUIPMENT

Absolute Coolant -proof caliper
Digimatic Depth Micrometer
Digital Micrometer
Dial Test Indicator.

Pre and post-NDT, such as ultrasonic testing or radiography, is typically performed to identify existing defects or irregularities like cracks or voids.

NON-DESTRUCTIVE TESTING EQUIPMENT

- IR Thermographic Testing Equipment
- Eddy Current Flaw Detector – NORTEC 600
- Digital Ultrasonic Flaw Detector – Karl Deutch – ECHOGRAPH 1090
- Ultrasonic Phase Array - M2M- GEKKO 170
- Digital Ultrasonic Thickness Gauge - CYGNUS 4
- X-Ray Radiography (Basic 2D microfocus Xray radiography)
- Magnetic particle inspection.

CONTACT DETAILS:

>> **Dr Robert Tshikudo**
RTshikhudo@csir.co.za