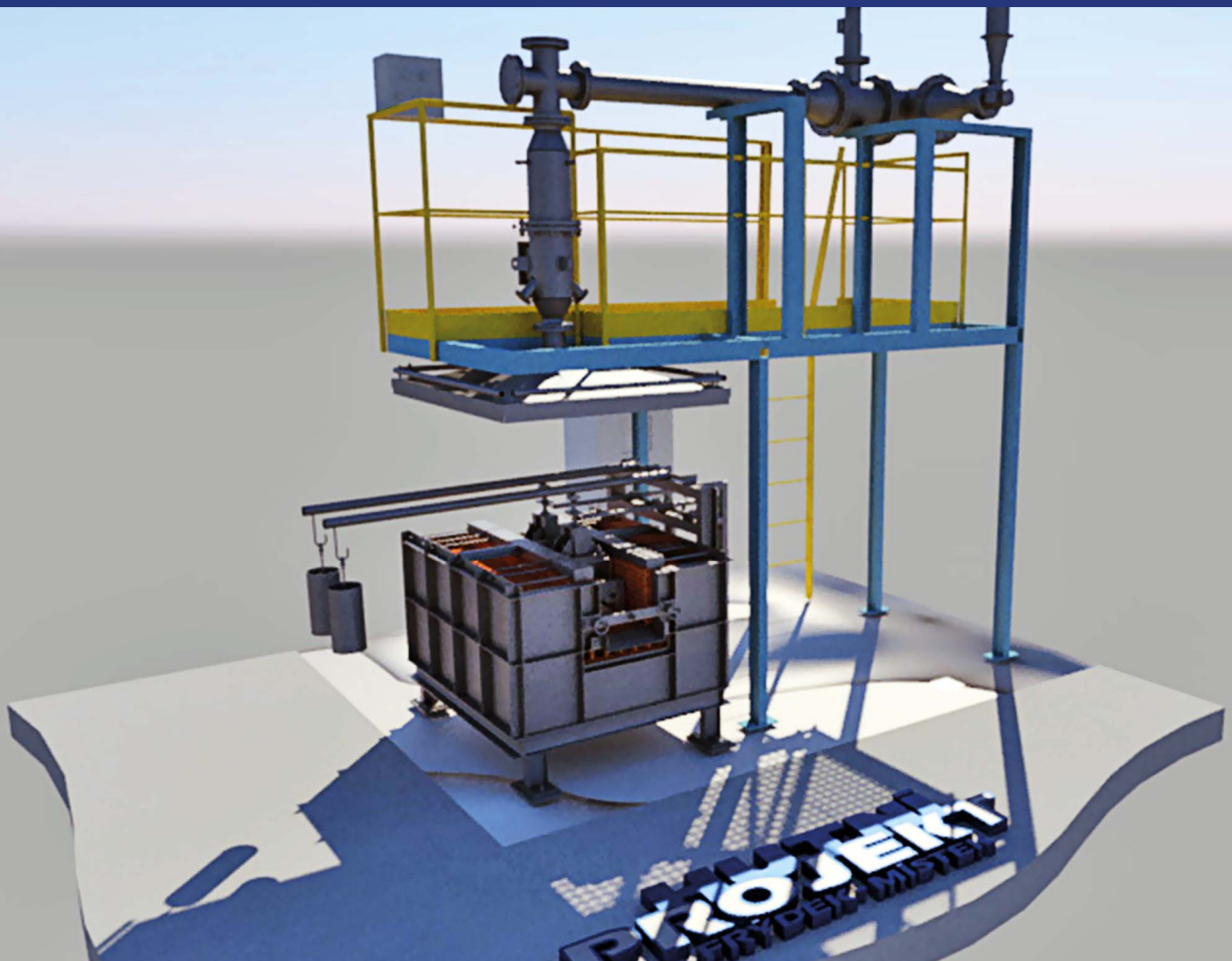


SH0 sole-heated oven

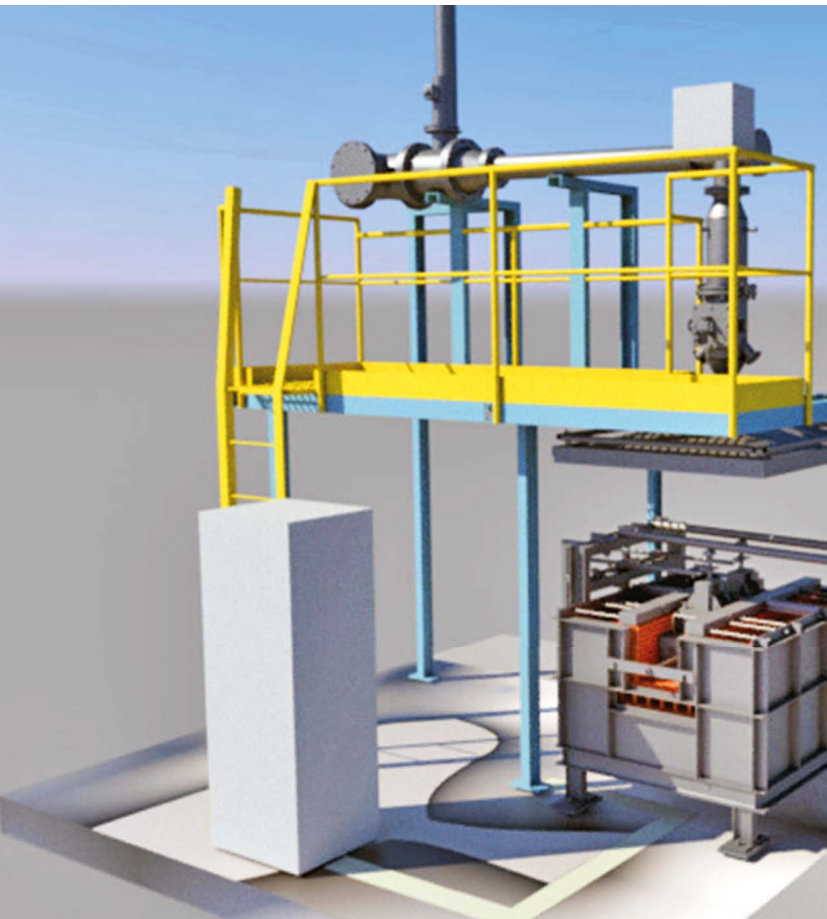


SOLE-HEATED OVEN

A tool for lab scale simulation of coal expansion or contraction behavior during carbonization

The Sole-Heated Oven is:

- designed to perform the ASTM Standard based large-scale laboratory test for obtaining information on the expansion or contraction of coal or coal blends during carbonization under specific test conditions,
- whereas the test method is applicable in the analysis of coals or coal blends intended for use in the manufacture of coke in conventional slot coke ovens,
- a multipurpose tool as the installation can also be exploited as a source of coke for rapid quality assessment involving relatively small amounts of coal sample.



Sufficient contraction of coal charge during carbonization in coke ovens is one of critical conditions enabling smooth pushing performance. Insufficient contraction, on the other hand, may lead to hard pushes or even stickers resulting in an elevated risk of oven damage, which is typically accompanied by a shortened battery service life and additional investment or repair costs.

After solidification of the charge, the contraction of the remaining semi-coke continues until the end of the coking process when a sufficient gap between the oven walls and the coke cake must be developed in order to create (coal charge-quality related) conditions for smooth oven pushing.

The sole-heated oven design replicates conventional carbonization process which is taking place in vertical coke ovens by cutting the charge in half and rotating it into the horizontal position.

During the test, a thickness of the charge is unidirectionally heated from the bottom surface accordingly with the pre-defined sole temperature program whereas the top surface is kept under constant load applied by a piston, thus simulating the resistance against free swelling as represented in the full-scale process by non-carbonized coal. At the end of the test, the thickness of the carbonized coal is observed and used for calculating experimental expansion or contraction characteristics that can be adjusted to selected reference bases of bulk density and moisture content.

The Sole-Heated Oven Design and Process Control:

- a double-chamber oven with brickwork shapes from SiC and high alumina content material,
- uniform heat distribution in the sole plate delivered by six SiC heating rods installed in protection tubes with over-heating control and alert system,
- Simatic S7 Process Control integrated in a power & control free-standing cabinet,
- PLC communication with the master system (e.g. Oracle),
- continuous expansion/contraction readings via linear movement transducer equipped with a micro pulse sensor with recording accuracy of 0.01 mm,
- automated data logging and transmission into external periphery simplifying the evaluation of process data,
- all furnace parameters visualized on Simatic HMI panel including graphical display of temperature and expansion curves,
- intuitive control via tailor made screens in a touch panel,
- suction hood and curtains for the elimination of gaseous emissions supported by forced combustion of raw gas using a propane burner.



SHO - oven chamber with piston guiding plates



The Sole-Heated Oven features:

- a double-chamber oven allowing for executing two tests in parallel, hence halving the analysis time of duplicate determinations,
- in combination with industrial coke oven process data, the pushing forces or pushing resistance in particular, a coal charge contraction limit can be derived and implemented as another coal blend design target,
- offers fast and operative analysis in emergency situations at the coke plant calling for immediate change in coal blend composition,
- less than 20-kg for a duplicate determination widens the field of applications in such instances where there is only limited amount of coal available for analysis such as borehole samples, sink-and-float density fractions, etc., and reduces the sample transportation costs,
- mechanized handling with heavy pistons using a portable electric lifter offering ergonomic solution with easy to operate control panel,
- can be employed as the source of coke for CSR determination after the heat treatment conditions of semi-coke have been defined and the qualities of produced coke have been cross validated with those in (semi)industrial scale.

SOLE-HEATED OVEN – TECHNICAL DATA

Oven dimensions (W x L x H)	1,274 mm x 1,452 mm x 722 mm
Nos of chambers	2
Dimensions of oven chamber	280 mm x 280 mm x 280 mm
Coal charge	2 x 6 kg
Testing temperature	554 ÷ 950 °C as per Sole Temperatures Program
Analysis time	app. 7 to 10 hours, depending on coal.
Required min. installation area (W x L x H)	app. 5,000 mm x 5,000 mm x 5,000 mm
Oven weight	app. 4,500 kg
Max. power consumption	27 kW
Natural gas consumption	0.4 m ³ /h (only during the coking process)
Compressed air consumption	6 m ³ /h (only during the coking process)

The Sole-Heated Oven – an invaluable tool in the lab given the speed of which man can ascertain information and on a smaller sample size!



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