

# **Pilot-scale Carbonization Tests in the DMT 10-kg retort**

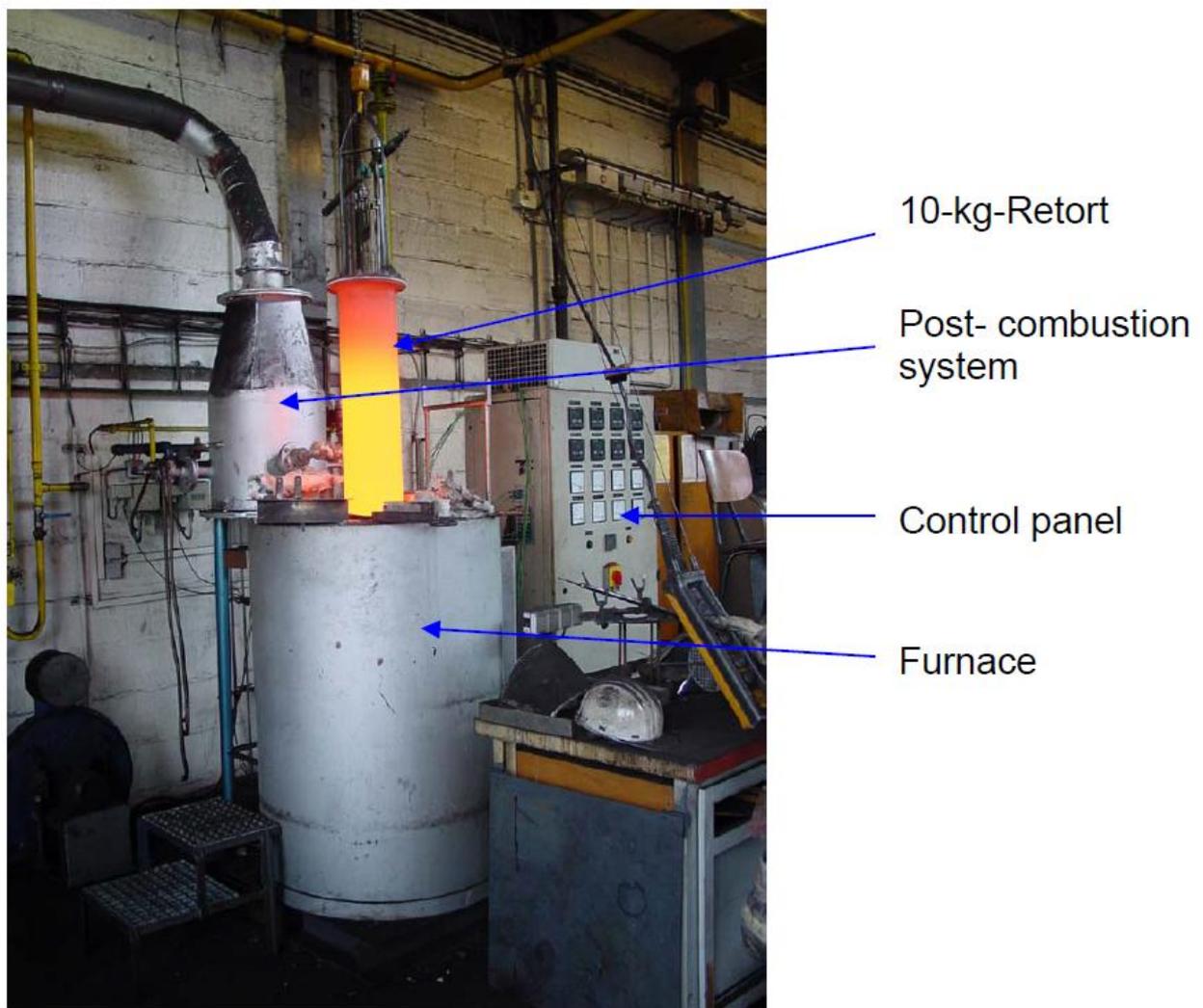


**DMT GmbH & Co. KG**  
**Cokemaking Technology – Cokemaking Services**

## Pilot scale carbonization tests in the DMT 10-kg retort

### DMT 10-kg retort and test procedure

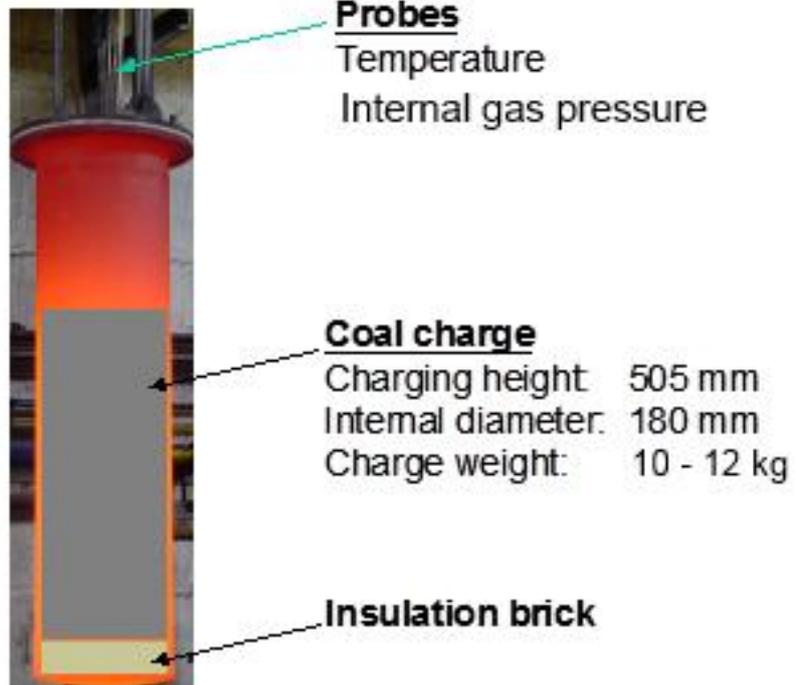
The pilot scale carbonization test (DMT 10-kg-retort) permits less time consuming investigations with limited quantities of coal (approx. 10-12 kg charging weight) in comparison to the semi-industrial coke oven. The equipment consist an experimental electrical heated furnace as shown in **Fig. 1** and a cylindrical retort, as shown in **Fig. 2**.



**Figure 1: Pilot scale carbonization test equipment**

**Final coke temperature:**  
1000 - 1030 °C

**Coking time:**  
approx. 4 hours



**Figure 2: Pilot scale carbonization retort (DMT 10-kg-retort)**

**Figure 2** contains the most important data of the carbonization retort. The semi-industrial scale oven is always operated as close as possible to the plant conditions; the heating conditions of the electrically heated retort are always fixed standard conditions. The delivered single coals are mixed according to blending program or used a single coal for the test. The blended coal charge or the single coal charge is crushed by an impact crusher to get the desired grain size distribution. The individual crushing of coal components are as well realizable. The homogenization and moisture content adjustment occurs in a mixer. The charge of the coal into the retort is made layer by layer to get a uniformly bulk density. The retort is lifted in the preheated furnace (furnace temperature 1,030 °C) after charging.

During each coking test the following parameters are monitored:

- temperature in the centre of the charge and
- internal gas pressure.

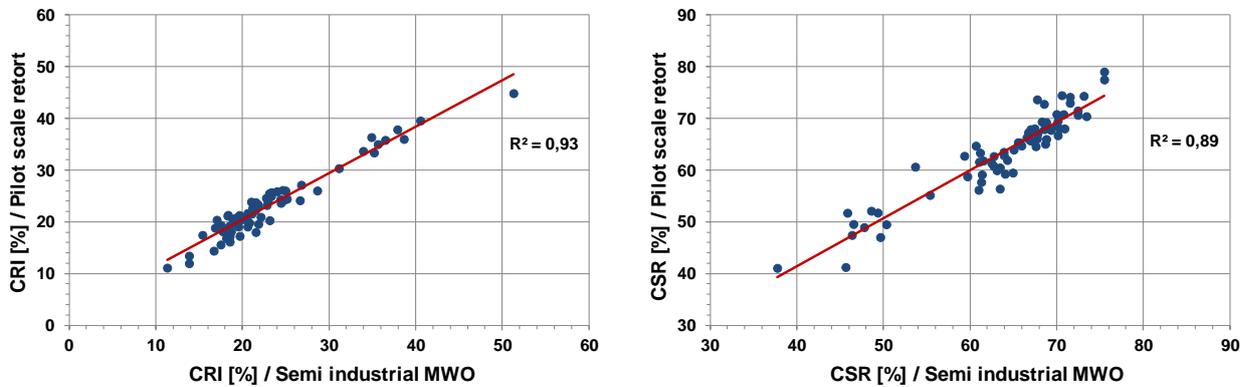
The retort is removed from the furnace after a coking time of 4h. The realized coke end temperature is between 1,000 and 1,030°C.

The produced amount of the coke is between 7 and 10 kg. A portion of a five kilogram greater than 20 mm is put into the ISO drum and tested by 100 and 500 revolutions. The determined values from the drum test are  $M_{30}$ ,  $M_{20}$ ,  $M_{10}$ ,  $I_{30}$ ,  $I_{20}$  and  $I_{10}$ . These values are not directly comparable with the drum tests values according ISO 556, but DMT is able to calculate the cold strength values that would most likely obtained in the DMT semi-industrial coke oven. Additionally, the CRI and CSR were determined according to ISO 18894.

### **Comparability of pilot scale test result to MWO results**

Despite from the fact that the course of carbonization differs in some details from the industrial scale oven the laboratory scale carbonization delivers valuable results concerning coke quality and coking behavior. DMT collect coke qualities and carbonization behavior data from coal and coal blend carbonization tests, which done parallel in the pilot-scale coking test retort and semi-industrial coke oven as well as in industrial coking plants, since 25 years. The pilot-scale coking test retort is dedicated for the fast and economical test for the determination of the CRI and CSR, estimation of mechanical strength and the first indication of the coking behavior.

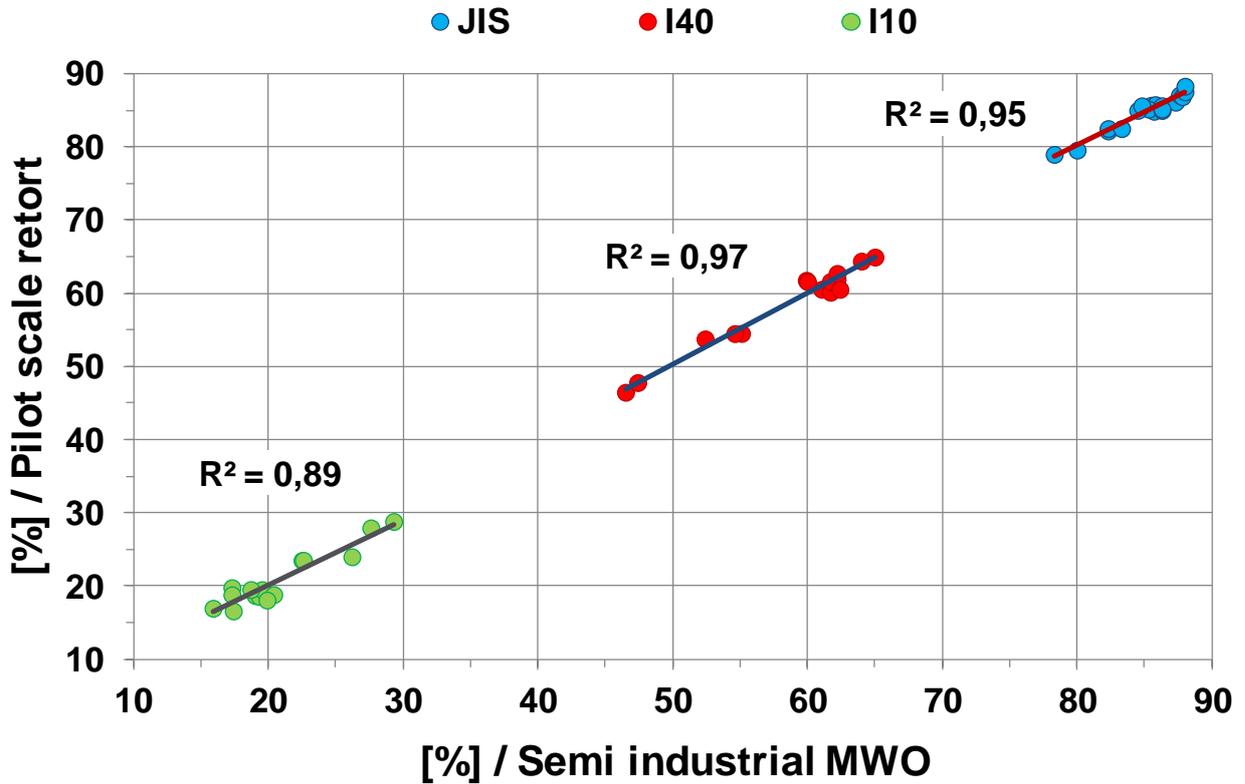
**Figure 3** shows the comparison between the obtained CRI and CSR values from the pilot scale coking test retort and the DMT movable wall oven.



**Figure 3: Comparison of CRI/CSR from pilot and semi-industrial scale**

DMT use the obtained  $M_{30}$ ,  $M_{20}$ ,  $M_{10}$ ,  $I_{30}$ ,  $I_{20}$  and  $I_{10}$  values from the drum test of the resultant coke from the pilot scale coking test to calculate the  $I_{40}$ ,  $I_{10}$  and JIS150/15 mechanical strength values that would be obtained in DMT semi-industrial coke oven.

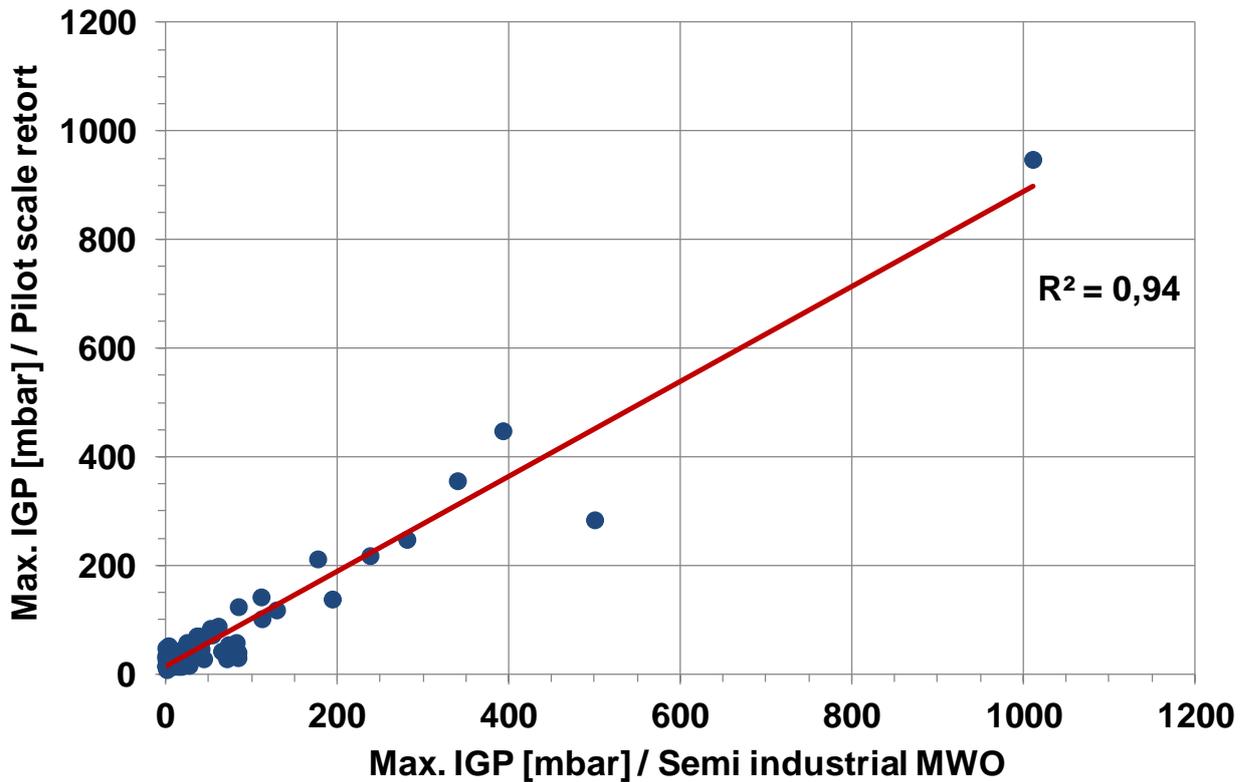
**Figure 4** displays the evaluated JIS,  $I_{40}$  and  $I_{10}$  values from the drum test of the of the produced coke from the pilot scale test and the JIS,  $I_{40}$  and  $I_{10}$  values from the coke which produced in the DMT semi industrial coke oven.



**Figure 4: Comparison of I<sub>40</sub>, I<sub>10</sub> and JIS DI 150/15 from pilot and semi-industrial scale**

The new interpretation of the pressure progression during the carbonization in the pilot scale coking test retort allows DMT to generate a prediction model. The prediction model allows with the extracted pressure data to estimate the maximum internal gas pressure and the wall load that would be most likely obtained in DMT semi-industrial coke oven.

**Figure 5** displays the calculated maximum internal gas pressure and the measured values at the industrial coke oven.



**Figure 5: Comparison of coking behavior from pilot and semi-industrial scale**

DMT can test focused coal blends in the pilot scale before testing in the MWO due to fact to have the possibility to adjust or reject the coal blend without huge loss of working and finance value. Furthermore, pilot scale carbonization testing enable the possibility to test coal blends with more critical options.

The pilot scale carbonization test can as well be used for a coal quality management. Tests with a coal at the semi-industrial DMT movable coke oven and the DMT 10-kg retort with similar results in terms of coke quality and coking behavior can be used to investigate samples of prospective bulks sales, probably in case of shipments from aboard to Europe. The needed 20 kg in comparison to the 1,000 kg for the MWO test is clear economical and easier to organize. An additional economic benefit is the clear lower cost of pilot scale carbonization tests.