

EFFECT OF BULK DENSITY OF COAL BLEND ON THE CALORIFIC VALUE OF COKE

© I.V. Miroshnichenko (PJSC "AZOVSTAL IRON & STEEL WORKS", 1, Leporskogo str., 87500, Mariupol, Ukraine), D.V. Miroshnichenko, Doctor of Technical Sciences (National Technical University "KhPI", 2, Kyrpychova str., 61002, Kharkiv, Ukraine), I.V. Shulga, PhD in technical sciences (State Enterprise "Ukrainian State Research Institute for Carbochemistry (UKHIN)", 7, Vesnina Str., 61023, Kharkiv, Ukraine), Yu.V. Nikolaychuk, PhD in technical sciences (Donbass State Pedagogical University, 19, General Batiouk St., 84116, Slavyansk, Donetsk Oblast, Ukraine)

The article is devoted to laboratory studies to determine the influence of the bulk density of a coal blend (in particular, tamped) on the value of the gross calorific value of the coke obtained from it. To making up a model coal blends, coal concentrates has been selected and analyzed from the raw material base of Ukrainian coke enterprises. From the studied coals four variants of coal blends has been formed, characterized by different grades. Experimental coking of coal charges has been carried out in a 5-kg laboratory oven designed by the State Enterprise "UKHIN". The bulk coking blend has been moistened to 8 %. The blend for tamping has been moistened to 12 %, tamped into a special matrix to a density of 1.15 t/m³, and then the tamped coal cake has been placed in a retort for coking.

It has been established that the maximum value of the gross calorific value of blast-furnace coke is achieved during coking of coal blends, which are characterized by the following set of quality indicators: $R_0=0,91-0,94$ %; $V^{daf}=30,9-31,0$ %; $C^{daf}=83,80-83,83$ %; $H^{daf}=5,01-5,02$ %; $O_d^{daf}=8,42-8,45$ %.

It has been shown that an increase in the bulk density of coal blends, characterized by the same set of quality indicators, from 800 to 1150 kg/m³ leads to an increase in the gross calorific value of blast-furnace coke by 0,05-0,12 MJ/kg.

Hydrogen bonds are a factor that contributes to the denser packaging of coal grains in the load. For this, the number of water molecules must correspond to the number of polar bonds in carbon macromolecules. With a lack of water, not all polar functional groups present in macromolecules will participate in the formation of new bonds, which will not allow to the coal grains to be packed more tightly. On the contrary, at higher humidity, excess water molecules will take up space in the feed, not participating in the formation of bonds with carbon macromolecules, which will lead to a decrease in the bulk density in terms of dry weight.

Keywords: coking, coal charge, bulk density, tamping, coke, moisture, gross calorific value.

Author for correspondence, e-mail: I.V. Miroshnichenko; igor.miroshnichenko@azovstal.com.ua