The resulting briquettes were divided into size classes to determine the yield of the suitable fraction when dropped from a height of 2 meters, which is acceptable for metallurgical processing. The fractional and chemical composition of the briquettes is shown in Table 2.

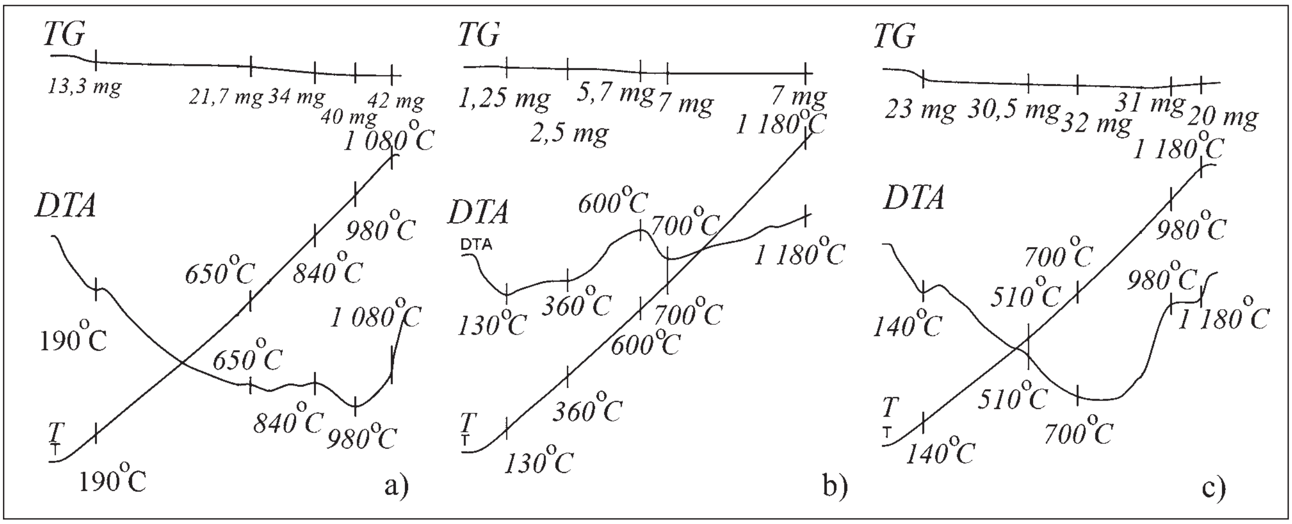
As can be seen from Table 2, the main share of the obtained briquettes (> 96 %) is a fraction of + 5 mm, which fully meets the requirements for charge materials according to the size class.

Table 2 **Fractional composition of nickel ore and long-flame coal briquettes when dropped from a height of 2 m**

| Fraction / mile | Quit / % | Quit / gr | Contents / % | | |
|---|---|---|---|---|---|
| +0 - 0,5 | 0,23 | 0,16 | | | |
| +0,5 - 1,5 | 0,45 | 0,31 | | | |
| +1,5 - 3 | 0,92 | 0,62 | | | |
| +3 - 5 | 0,83 | 0,57 | 1,23 | 1,69 | 14,38 |
| +5 | 97,57 | 66,7 | | | |
| Σ | 100 | 68,36 | | | |
| +3-5 and +5 | 98,4 | 67,27 | | | |

In addition to the metallurgical estimates of nickel ores, we studied the physical and chemical properties of briquettes under heating [9-11]. The materials were studied on a derivatograph of the system F. Paulik, J. Paulik, L. Erdei Derivatograph Q = 1 000 in the temperature range 20 - 1 400 ºC with a heating rate of 10 ºC / min. The temperature in the furnace was measured by a platinum-platinum-rhodium thermocouple [9,10]. The studies were carried out in an oxidizing atmosphere. On the derivatograms, these analyses are shown in the form of thermogravimetric (TG) and differential-thermoanalytic (DTA) curves [12, 13]. The material under study consisted of: briquettes 1 (ore+coke), briquettes 2 (ore+coal) and briquettes 3 (ore+silicon-aluminum reducing agent) (Figure 1 a, b, c). Table 3 below shows the chemical and technical compositions of the materials under study.

The processes occurring in the nickel briquette 1 (Figure 2, a) have five kinks. At a temperature of 190 °C, the first endothermic effect is manifested, accompanied by the removal of hygroscopic and adsorbed moisture with a decrease in the sample mass by 13,3 mg. The second weakly expressed exothermic effect, observed at a temperature of 650 °C, is due to the completion of the release of hydrate moisture and the complete removal of volatile components. The total weight loss at this temperature was 21,7 mg. In addition to these processes, in the temperature range of 500 - 600 °C, some physical and chemical transformations occur - the decomposition of serpentine ($3MgO·2SiO_2·2H_2O$) and siderite ($FeCO_3$). A further increase in temperature leads to the interaction of the nickel briquette with the reducing agent. At a temperature of 840 °C, a third pronounced exothermic effect is observed at a decrease in




a) nickel briquette (ore + coke), b) nickel briquette (ore + coal), c) nickel briquette (ore + silicon-aluminum reducing agent)

**Figure 2** Derivatograms of nickel briquettes

Table 3 **Chemical and technical compositions of the studied materials [9]**

<table>
<tr><td rowspan="2">Materials</td><td colspan="16">Chemical composition / %</td></tr>
<tr><td colspan="2">$Ni_{general}$</td><td colspan="4">$Fe_{general}$</td><td colspan="2">$Cr_{general}$</td><td colspan="2">$SiO_2$</td><td colspan="4">MgO</td><td colspan="2">$Al_2O_3$</td></tr>
<tr><td>Nickel ore</td><td colspan="2">1,23</td><td colspan="4">14,38</td><td colspan="2">1,69</td><td colspan="2">51,57</td><td colspan="4">3,52</td><td colspan="2">1,87</td></tr>
<tr><td rowspan="2">Silicon-aluminum reducing agent</td><td colspan="4">Al</td><td colspan="4">Si</td><td colspan="4">Cr</td><td colspan="4">Fe</td></tr>
<tr><td colspan="4">14,41</td><td colspan="4">25,11</td><td colspan="4">36,92</td><td colspan="4">16,12</td></tr>
<tr><td rowspan="2"></td><td colspan="16">Technical staff / %</td></tr>
<tr><td colspan="4">$A^c$</td><td colspan="4">W</td><td colspan="4">$V^c$</td><td colspan="4">C</td></tr>
<tr><td>Coke</td><td colspan="4">19,38</td><td colspan="4">2,44</td><td colspan="4">6,19</td><td colspan="4">73,86</td></tr>
<tr><td>Coal</td><td colspan="4">9,85</td><td colspan="4">4,8</td><td colspan="4">35</td><td colspan="4">49,99</td></tr>
</table>

* where $A^c$ - ash content of coal ($^C$ on dry weight); $V^c$ - volatile components; W - humidity