European Mineralogical Conference
Vol. 1, EMC2012-733, 2012
European Mineralogical Conference 2012

Slags as a new type of mineral resource: special features of technogenic ruby and diaoyudaoite of wastes from Cr-V production

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Currently interest in the processing formations of α-Al_2O_3 and other materials in the slags of metallurgical industries not only theoretical and scientific, but also purely practical. Their secondary using can provide the possibility of obtaining easily accessible as abrasive, and in some cases, as the material for the jewellery industry.

We investigated the material of slags, which have been produced during processing of Cr-V ores at a Ferroalloy Plant (Ural, Russia). We used the methods for research: microscopy, EDXRD, XRD and laser photoluminescence.

The following components (in wt.%) have been found in these slags: Al_2O_3 - 85; Cr_2O_3 - 7; Na_2O - 5; SiO_2 - 1; MgO + CaO + SO_3+ Cl - less than 1. Besides we identified that the slags consist of ***diaoyudaoite*** $NaAl_{11}O_{17}$ (rare green coloured mineral, discovered in Japan in the 80^{th} of last century) – 75 wt.%, red corundum α-Al_2O_3 (***ruby***) – about 20 wt.%, and ***magnetite*** $Fe^{2+}Fe_2^{3+}O_4$ – 5 wt.% (Sorokina et al., 2010). Ruby - diaoyudaoite slag has a porphyritic structure (fig. 1). Diaoyudaoite is generally more euhedral comparing to ruby, the size of minerals varies from 1 to 24 mm (average 12 mm). Magnetite (grain size 0.2 – 0.6 mm) presents as rounded inclusions in ruby and diaoyudaoite, as well as in their grain boundaries.

Diaoyudaoite has a lamellar crystal morphology, which is closely similar with mica, but diaoyudaoite microhardness is much huger - about 1410 kgs/mm^2. Besides the mineral shows a characteristic parting, which is can be mistaken with pyroxene one. We have also identified some of it new optical parameters – elongation, pleochroism and formula of absorption (Sorokina et. al., 2010).

We observed the internal structure of rubies from these slags and found curved growth lines and gas bubbles, which are similar to Verneul synthetic analogues (Sorokina, 2011). Technogenic rubies showed an intense orange-red luminescence, the lines of Cr^{3+} (692 and 694 nm) are present in their luminescence spectra.

Further research will allow predicting the possible methods of treatment in order to obtain a new type of mineral resource from slags of Cr-V production.

Acknowledgments: to prof. E.G. Ozhogina and other colleagues from FGUP VIMS.

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