SINTERING OF DUST AND SLUDGE GENERATED IN FERRONICKEL PRODUCTION FROM THE OXIDIZED ORES

Description:
The basic method of Ni reclamation from oxidized nickel (mostly laterite) ores is their pyrometallurgical processing. There are about 20 plants all over the World which process the ores and more then a half of them produces Ni in a form of ferronickel. The object of the development is recycling fine waste in a form of dust and sludge that is generated in large amounts at the majority of ferronickel enterprises. The current most common ferronickel technology includes several operations. They are pretreating of laterite ore by its crushing down to required small size particles and mixing it with lime and carbon reductant followed by calcining it in a rotary kiln. The produced calcine is smelted in submerged arc furnace for production of crude ferronickel with the unavoidable high carbon and silicon contents. The last melt stage is metal refining from these mostly undesirable elements by oxidation in converter. All stages and especially calcining operation are accompanied by fine waste generation. Calcining in rotary kiln is energy efficient operation. However it has very often insufficient utility in recycling agglomerates in a form of the pelletized or pressed waste without heat treating. The mechanical and the thermal stresses on the agglomerates occur during their motion through a tube of the kiln with a high temperature gradient. So the sufficient part of agglomerates is damaged. As a result the new portions of the fine waste are repeatedly generated at that time. Moreover the current tendency for broadening of usage of the tropical ores as ferronickel feedstock leads to sufficient increase of amount of the generated waste. The large wetness in the ores accompanied by their advanced brittleness accelerates formation of fines in rotary kilns. Currently the efforts for application of sintering process for agglomeration of the waste are being resumed in Ukraine. Sintering is the well known and the widely used method for ferrous metallurgy. However strength of the nickeliferous sinter produced by application of the traditional regimes and feedstock is sufficiently low. So it has been rarely applied in processing of the nickeliferous fines.

Innovative aspect and main advantages:
The developed technology anticipates application of the same equipment as the traditional sintering. However usage of the new grades of reductant along with optimization of the ratio between compounds of an initial charge has brought about sufficient increase of the mechanical properties of the sinter at the cold and the hot states. Efficiency of the innovation was proved in the laboratory conditions. The waste was mixed with the additions in the drum pelletizer (a). Next the produced pellets were processed in the sintering pot (b). The received lots of the sinter (c) for 25-30 kg each were tried for mechanical strength at the test unit (d) by its repeated dropping on the steel plate. The rate of wearability was found out by putting the sinter into the specific rotating drum (e). All got indices were as high that they tolerated the standard rigid requirements for the ferrous sinter.

The behavior of the hot sinter was investigated by its smelting in the laboratory submerged arc furnace (f) for production of ferronickel. As the result the extraction of Ni from it was nearly the same as from the calcine got from the ore. Such outcome can not be demonstrated on any other nickeliferous agglomerate. Also as accessory advantage the innovative sintering technology may give the means for broad usage of the secondary energy resources including some agricultural residues.

Areas of application:
Processing of all types of ferronickel waste and brittle nickeliferous ores.

Stage of development:
The new technology was developed and successfully tried at the laboratory conditions. Our R&D team has longstanding experience in reduction the analogous technologies just after such trials to practice of the integrated steel mills of Ukraine, Russia and Kazakhstan.

Contact details:
Dr. Eugene Zhidkov
Head of Department
Gas Institute of National Academy of Science of Ukraine
39 Degtyarivska Str., 03113, Kyiv, Ukraine
Phone: +38044-424-6057; +38044-456-4057
Fax: +38044-456-8830
E-mail: vlads @visti.com