THEORETICAL ANALYSIS OF THE TECHNOLOGY FOR SEPARATION OF IRON OXIDES FROM BASALT USED AS A FILLER FOR POLYVINYLCHLORIDE

A.A. Jumaeva[1],
U.F.Ahmedova[1]
B.M.Berdieva[1],
[1]Karshi State Technical University

Abstract. *Currently, significant scientific research is being conducted on the use of basalt ore as a filler for polymer materials. The advantage of basalt compared to other fillers lies in its complex multi-component composition, which contributes to improving the physical and mechanical properties of polymers. This makes it possible to replace imported fillers with locally available basalt resources, thereby reducing production costs and increasing the utilization of domestic raw materials. However, before basalt can be used as a filler, it must undergo several stages of mechanical processing, including crushing, grinding, and classification. In addition, purification from certain metal oxides is required, which can be effectively achieved using magnetic separation methods. Magnetic separators enable the removal of ferromagnetic impurities, improving the quality and performance of the final polymer composite material.*

Keywords: *magnetic separator, polymer, filler, basalt, metal oxides.*

Introduction

Iron is one of the most important industrial metals and is primarily obtained from iron ores containing iron oxides such as FeO, Fe_2O_3, and Fe_3O_4. These oxides differ in oxidation state, magnetic behavior, and chemical reactivity. Efficient separation of these oxides is necessary to improve iron extraction and reduce energy consumption in metallurgical processes .

Iron(II) oxide (FeO), also called wüstite, contains iron in the +2 oxidation state, while iron(III) oxide (Fe_2O_3), known as hematite, contains iron in the +3 oxidation state. Due to differences in magnetic properties and reducibility, these oxides can be separated using physical and chemical methods[1] .

The purpose of this thesis is to explain the methods used for separating FeO and Fe_2O_3 from iron ore and their industrial applications.

Magnetic separators are widely used devices designed to separate ferromagnetic particles under the influence of a magnetic field. The operating principle of these separators is based on the selective attraction of magnetically susceptible particles from a moving material stream when exposed to a magnetic field. As the material passes through the separator, particles possessing ferromagnetic or paramagnetic properties are attracted toward the magnetic source, while non-magnetic particles continue along their original trajectory. This mechanism enables efficient separation of materials based on differences in magnetic susceptibility.

Magnetic separators may employ either permanent magnets or electromagnets, depending on the required magnetic field strength and operational conditions. Permanent magnet separators are commonly used due to their energy efficiency, operational simplicity, and low maintenance requirements. In contrast, electromagnetic separators offer the advantage of adjustable magnetic field intensity, making them suitable for applications requiring precise control over the separation process[2]. These devices are extensively applied in various industrial sectors, including mining, metallurgy, food processing, chemical engineering, and recycling industries, where they play a critical role in material purification, recovery of valuable components, and removal of unwanted ferromagnetic impurities.

The performance and efficiency of magnetic separators are influenced by several factors, including separator design, magnetic field strength and distribution, particle size, material properties, and operating conditions such as feed rate and particle velocity. Optimization of these parameters is essential for achieving high separation efficiency and improving overall process performance. Consequently, the development of advanced magnetic systems and the optimization of separator operating modes represent important scientific and engineering challenges. Modern research focuses on improving magnetic field configurations, enhancing separator design, and increasing energy efficiency, thereby contributing to more effective and sustainable industrial processing technologies[3-4].

A magnetic drum separator consists of: Rotating drum, Magnetic field source,Feed system, Collection system,When crushed ore passes over the drum:

Magnetic particles (FeO-rich) stick to the drum

Non-magnetic particles (Fe_2O_3-rich) fall away

This produces two fractions:Magnetic fraction: FeO-rich concentrate; Non-magnetic fraction:Fe_2O_3-rich material[5].

Industrial Importance: Magnetic separation is widely used in: Iron ore beneficiation plants, Steel manufacturing industries**,** Mineral processing plants

It improves iron recovery and reduces impurities .The process sequence for removing iron oxides from basalt using a magnetic separator, for its application as a polymer filler, is shown in Figure 1.

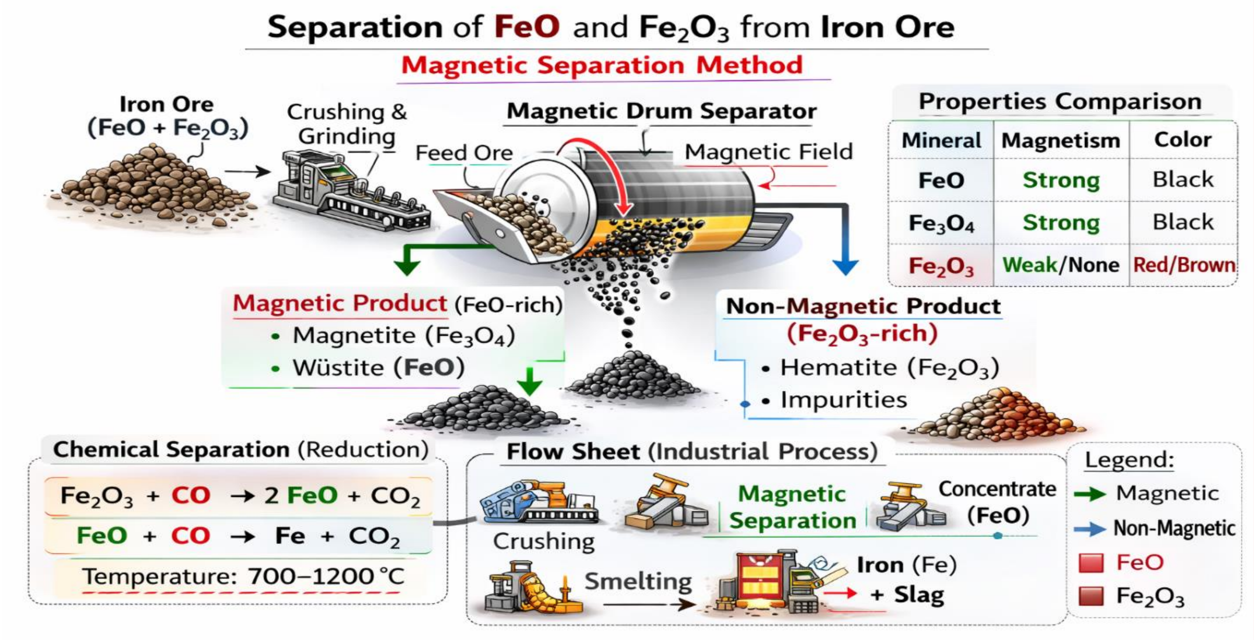

Figure 1. Process flow diagram for the removal of iron oxides from basalt.

References

1. Hunt C. P., Moskowitz B. M., Banerjee S. K. Magnetic Properties of Rocks and Minerals // Rock Physics and Phase Relations: A Handbook of Physical Constants. – Washington: American Geophysical Union, 1995. – P. 189–204.

2. Dunlop D. J., Özdemir Ö. Rock Magnetism: Fundamentals and Frontiers. – Cambridge: Cambridge University Press, 1997. – 573 p.

3. Evans M. E., Heller F. Environmental Magnetism: Principles and Applications of Enviromagnetics. – San Diego: Academic Press, 2003. – 299 p.

4. Cornell R. M., Schwertmann U. The Iron Oxides: Structure, Properties, Reactions, Occurrences and Uses. – Weinheim: Wiley-VCH, 2003. – 664 p.

5. V. A. Gramm, K. V. Nikolaenko, and A. G. Fedotov, *Operator of Magnetic Separators: Worker's Handbook*. Moscow, Russia: Nedra, 1990.