

Research Article

Characterization of Ladle Furnace Slag from Carbon Steel Production as a Potential Adsorbent

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A promising type of steel slag for applications is the ladle furnace (LF) slag, which is also known as the basic slag, the reducing slag, the white slag, and the secondary refining slag. The LF slag is a byproduct from further refining molten steel after coming out of a basic oxygen furnace (BOF) or an electric arc furnace (EAF). The use of the LF slag in further applications requires knowledge of its characteristics. The LF slag characterization in this paper has been performed using the following analytical methods: chemical analysis by energy dispersive spectrometry (EDS), mineralogical composition by X-ray diffraction (XRD), surface area properties by the Brunauer-Emmett-Teller (BET) and the Barrett-Joyner-Halenda (BJH) methods, surface chemistry by infrared absorption (FTIR) spectroscopy, and morphological analysis by scanning electron microscopy (SEM). The results showed that the main compounds are calcium, silicon, magnesium, and aluminium oxides, and calcium silicates under their various allotropic forms are the major compounds in the LF slag. Surface area properties have shown that the LF slag is a mesoporous material with relatively great BET surface area. The ladle furnace slag is a nonhazardous industrial waste because the ecotoxicity evaluation by its eluate has shown that the LF slag does not contain constituents which might in any way affect the environment harmfully.

1. Introduction

Many million tons of slag are generated as it is a byproduct of iron- and steelmaking industry during the separation of the molten iron and steel from impurities. There are four types of iron and steel industry slags, namely, the blast furnace (BF) iron slag, the basic oxygen furnace (BOF) the steel slag, the electric arc furnace (EAF) steel slag, and the ladle furnace (LF) basic slag, also called the secondary refining slag or the white slag. The ladle furnace basic slag is produced in the final stages of steelmaking, when the steel is desulfurized in the transport ladle, during what is generally known as the secondary metallurgy process [1, 2]. The most important functions of the secondary refining processes are the final desulfurization, the degassing of oxygen, nitrogen, and hydrogen, the removal of impurities, and the final decarburization (done for ultralow carbon steels) [3].

The increase in steel consumption is thus the cause of the generation of slag, and, consequently, the growth in slag volume had impact on developing various methods of

slag utilization. Relevant data published during the past two decades have demonstrated the suitability of some of these materials, from both a technical and an economic perspective [4, 5]. Slags from iron and steel production have long been regarded as useful materials in building and civil works. Steel slag can be utilized in many different areas such as soil conditioners, fertilizers, sinter material, production of cement and concrete, and so forth [6]. Each type of slag has its own characteristics such as the use of ground granulated BF iron slag, as an addition to the Portland cement. Furthermore, BOF slag and EAF slag are used in asphaltic mixes and road-base layers. The practical application of the LF slag differs from the latter due to its specific characteristics. Good examples are found in agriculture for the correction of soil acidity and in cement industry as raw material for the Portland clinker fabrication [7].

With the rapid development of industries such as metal plating facilities, mining operations, fertilizer industries, tanneries, batteries, paper industries, pesticides, and so forth, heavy metals wastewaters are directly or indirectly discharged

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Characterization Of Ladle Furnace Slag From The Carbon:

Mining and Metallurgical Wastes Based Alkali-Activated Materials Zengqing Sun,2024-11-29 This book reviews the recent scientific developments on mining and metallurgical wastes based alkali activated materials MMWAAMs. Enormous quantities of solid wastes are generated during the exploitation of ore deposits and the subsequent processing for materials causing serious environmental problems. Alkali activation is one of the robust technologies that converts mining and metallurgical wastes into value added materials and offers technological solutions for efficient stabilization of toxic components in mining and metallurgical wastes. Herein this book presents the development of the design processing routes and performances of mining and metallurgical waste based alkali activated materials. It highlights in detail the relationships between the physicochemical characteristics of the source materials and the properties of synthesized binders. From the durability perspective both the applicability of testing protocols and degradation mechanisms are also reviewed with significant experimental and modeling work presented. Furthermore the transformation paths of initially toxic components during alkali activation partitioning characteristics as well as the assemblages of solubility controlling mineral phases are discussed for detailed environmental compatibility evaluation. In addition applications and perspectives for future directions of mining and metallurgical wastes based alkali activated materials are illustrated. By bringing state of the art knowledge this book appeals to a broad readership particularly researchers engaged in material and environmental science mining and metallurgical engineering and other related fields.

Chromatographic Analysis of the Environment Leo M.L. Nollet,Dimitra A. Lambropoulou,2017-03-03 This detailed handbook covers different chromatographic analysis techniques and chromatographic data for compounds found in air water and soil and sludge. The new edition outlines developments relevant to environmental analysis especially when using chromatographic mass spectrometric techniques. It addresses new issues new lines of discussion and new findings and develops in greater detail the aspects related to chromatographic analysis in the environment. It also includes different analytical methodologies addresses instrumental aspects and outlines conclusions and perspectives for the future.

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Processing and Characterization of Materials Archana Mallik,2020-02-19 International Conference on Processing and Characterization of Materials ICPCM 2018 Selected peer reviewed papers from the International Conference on Processing and Characterization of Materials ICPCM 2018 6-8 December 2018 Odisha India

Treatise on Process Metallurgy Alexander McLean,Roderick Guthrie,Sridhar Seetharaman,H. Y. Sohn,2024-08-23

Treatise on Process Metallurgy Volume Four Industrial Production provides academics with the fundamentals of the manufacturing of metallic materials from raw materials into finished parts or products. In these fully updated volumes

coverage is expanded into four volumes including Process Fundamentals encompassing process fundamentals structure and properties of matter thermodynamic aspects of process metallurgy and rate phenomena in process metallurgy Processing Phenomena encompassing interfacial phenomena in high temperature metallurgy metallurgical process phenomena and metallurgical process technology Metallurgical Processes encompassing mineral processing aqueous processing electrochemical material and energy processes and iron and steel technology non ferrous process principles and production technologies and more The work distills the combined academic experience from the principal editor and the multidisciplinary four member editorial board Provides the entire breadth of process metallurgy in a single work Includes in depth knowledge in all key areas of process metallurgy Approaches the topic from an interdisciplinary perspective providing broad range coverage on topics The Microscopic Analysis of Metals Floris Osmond,1913 **Papers and Discussions**

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Waste Production and Utilization in the Metal Extraction Industry Sehliselo Ndlovu,Geoffrey S. Simate,Elias Matinde,2017-06-27 Increasingly stringent environmental regulations and industry adoption of waste minimization guidelines have thus stimulated the need for the development of recycling and reuse options for metal related waste This book therefore gives an overview of the waste generation recycle and reuse along the mining beneficiation extraction manufacturing and post consumer value chain This book reviews current status and future trends in the recycling and reuse of mineral and metal waste and also details the policy and legislation regarding the waste management health and environmental impacts in the mining beneficiation metal extraction and manufacturing processes This book is a useful reference for engineers and researchers in industry policymakers and legislators in governance and academics on the current status and future trends in the recycling and reuse of mineral and metal waste Some of the key features of the book are as follows Holistic approach to waste generation recycling and reuse along the minerals and metals extraction Detailed overview of metallurgical waste generation Practical examples with complete flow sheets techniques and interventions on waste management Integrates the technical issues related to efficient resources utilization with the policy and regulatory framework Novel approach to addressing future commodity shortages

Cooperative Bulletin: Mining and Metallurgical Investigations Carnegie Institute of Technology,1926 **Innovative Materials for Construction** Mariaenrica Frigione,José Barroso de Aguiar,2021-05-05 Most of the typical materials

employed in today's constructions present limitations especially concerning their durability in either common or severe environmental conditions and their impact on the environment. In response to these issues, academic and industrial efforts around the world have been devoted to developing new smart materials that can provide efficient alternatives, improve the energy efficiency of buildings or can upgrade, repair or protect existing infrastructures. Different and wide technological innovations are therefore quickly fostering advancements in the field of construction materials. A new generation of materials—bricks, cement, coatings, concrete, FRP, glass, masonry, mortars, nano materials, PCM, polymers, steel, wood, etc.—is gaining a prominent position in modern building technology since they can overcome various limits and flaws of conventional materials employed in constructions without neglecting the smart applications of pioneering materials in ancient constructions and historic buildings. Even though the adoption of innovative materials in the construction field has been a successful route in achieving enhanced performance or even new and unexpected characteristics, some issues have not been completely solved. On top of them, the cost-performance ratio of novel solutions since their introduction must be convenient without compromising quality. Other concerns are related to their sustainability with eco-friendly options possibly exploiting recycled materials or by-products from other productions being the most desirable solution. Finally, the use of materials or systems that are unconventional in this field raises the need to update or develop new specifications and standards. This special issue aims at providing a platform for discussing open issues, challenges and achievements related to innovative materials proposed for the construction industry.

Machinery, 1919 Engineering; an Illustrated Weekly Journal, 1903 **The Iron Age**, 1911 **Transactions** American Institute of Mining, Metallurgical, and Petroleum Engineers, American Institute of Mining Engineers, 1914. Some vols. 1920–1949 contain collections of papers according to subject.

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