

THE PROSPECTS OF GREEN STEELMAKING INDUSTRY

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Анотація:

У статті розглядається екологічне виробництво сталі як перспектива у розвитку світової металургії. Проаналізовано методи виготовлення сталі та переваги виробництва.

Ключові слова: сталь, виробництво, сировина, екологічність, матеріали, переробка, сплави, зелене виробництво.

Abstract:

The article considers the green production of steel as a prospect in the developed of world metallurgy. The methods of steelmaking and the advantages of production are analyzed.

Keywords: steel, production, raw materials, environmental friendliness, materials, processing, alloys, green production.

Introduction

Metallurgy keeps up with many industrial sectors in following the main world trends with the main focus on the 'green production of steel'. This allows the segment to withstand environmental problems and pressure from regulatory authorities. In the future steel will be produced in a sustainable, carbon-free, safe, intelligent and modernized way, which will help create materials with better characteristics than they are now.

Basics

It's already no longer necessary to prove the need for transferring to the "green production of steel", which is called out to make the manufacturing process more environmentally friendly. There are several directions to pursue in this area. The first is considered to be the most environmentally impactful now: that is switching from carbon to hydrogen. Carbon-reducing agents are replaced with hydrogen in different ways.

The hydrogen-based decision for the direct reduction, which allows using any type of iron ore, can almost exclude a carbon footprint during the iron-manufacturing process. Carbon dioxide emissions will be close to zero. The by-products will be processed, and the processes will be realised with maximum energy efficiency. Some steelmakers have already started using hydrogen instead of carbon and plan to switch to hydrogen by 2025. The required industrial facility is absent so far, and when it is launched, it will operate on a small scale. Some industrial facilities will be launched in 2021.

The second "green" direction, which has been already used in metallurgy for a long time, is the direct reduction of semi-finished products to manufacture steel from high-ferrous raw materials, using special technologies (Midrex, Arex, Hyl, etc.). So-called metallized raw materials – hot-briquetted iron (HBI), metallised pellets made of DRI (Direct Reduced Iron), and sponge iron – are produced in such a way. These are metal products with high iron content (up to 99%), which can be immediately used in the steelmaking process. Such direct iron is the main material to produce electric steel and is used to replace scrap and other iron-containing components. This technology has been developed for more than 30 years already. Its efficiency has been proven to some extent, but this technology initially requires the availability of highly clean ore materials – iron-containing raw materials with high Fe content and low content of impurities – or the availability of large generating capacities.

That is why such production lines are located in Brazil or in Australia, close to mining enterprises with the availability of very good ore, and in the Middle East, which possesses excessive amounts of cheap gas that can be used to recover the iron from iron-containing raw materials.

Today, direct-reduction technology has already become one of the leading and the most widely used techniques in the field including basic oxygen furnace and electric steelmaking processes. If speaking about modern steelmaking technologies, the basic oxygen furnace (BOF) and electric steelmaking processes are the keys. The open-hearth (OHF) steelmaking method is used less and less in the world of metallurgy. This is again related to the 'green ecology' to a large extent. It is known that OHF heat lasts 9 hours, while the BOF and electric steelmaking processes require only 50 minutes. It's true that both the BOF and electric furnace require additional equipment, while, in general, everything can be made in one machine if speaking about the OHF. Nevertheless, the OHF manufacturing process is more costly in terms of both necessary energy resources and environmental impacts. Natural gas is used here, which results in large emissions into the atmosphere. About 70% of steel is produced in BOFs nowadays, while 29% is smelted in electric furnaces and only a small amount in OHFs.

Conclusion

"Green steel production" is the future of steel making industry, it should be a prospect in the development of world metallurgy in general, the benefits such as a significant improvement in material characteristics, reduced costs and harmful emissions will only accelerate the transition to this method of production.

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