

HISTORY AND NEW MILESTONES IN SUBMERGED ARC FURNACE TECHNOLOGY FOR FERRO ALLOY AND SILICON PRODUCTION

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As far back as in 1906, the SMS group delivered the first submerged arc furnaces. Meanwhile - over the last 100 years - SMS supplied more than 750 submerged arc furnaces and major components to our customers worldwide, which operate plants for the production of ferroalloys, Si-metal, non-ferrous metals and other applications. The smelter departments of the SMS group in Düsseldorf, Germany and Johannesburg, South Africa worked out numerous solutions to ensure the profitability of the operating industry in the ferroalloy business. Many highly interesting and challenging furnace projects are being implemented, including the world's largest FeNi furnace for POSCO SNNC, South Korea, the FeCr production line based on DC-technology working with an electrode column for JSC Kazzchrome, the first FeMn/SiMn-plant equipped with hybrid gas cleaning system (scrubber system - wet ESP combination) for Sakura/Malaysia, modern calcium carbide furnaces for two clients in China, one modern smelter for a FeNi production line and innovative smelter for fused magnesia production. The paper will present the status of these projects. Furthermore, new solutions regarding energy recovery and other auxiliary equipment as well as innovation and future concepts will be presented.

SMS GROUP, BENEFITS FOR THE WORLD MARKET

Usually, most of the ferroalloys and special slags are produced in electric smelters/submerged arc furnaces. The SMS group has a market share of more than 50% of the western world. During the last 100 years, the SMS group developed the furnaces to such extent that it is today utilized for more than 20 different main industrial areas such as iron, ferroalloy, chemical industry, lead, zinc, copper, refractory, titanium oxide, recycling, phosphorus etc. [1, 2]. Such an evolution was only possible due to tremendous efforts in research and development, a large range of design solutions and finally the initiatives and visions of our clients resulting in joint trendsetting developments. The worldwide strong competition also forced the industry and technology suppliers to improve the efficiency and economy adapting to the market conditions. Regarding the environment, the plants improved significantly in terms of gas cleaning and energy efficiency [3].

THE HISTORY OF SUBMERGED ARC FURNACE TECHNOLOGY

The increasing demand for ferroalloys and desoxidation agents in steelmaking at the beginning of the 20th century led to the development of the first industrial electric smelters. SMS which has been a major supplier for the iron and steel industry for the last 100 years started with the construction of the first submerged arc furnace in 1905. The 1,5 MVA unit was installed in Horst Ruhr/Germany for the production of calcium carbide and was successfully commissioned in 1906. Development of large electrode systems, advanced transformer technology and new furnace construction principles allowed the design of large-capacity rectangular SAF's with current dimensions of up to 40 m in length. Over 99 % of the furnaces are AC based, either with three or six inline electrode systems for rectangular furnaces, or with three electrodes for circular furnaces [1, 2]. This will remain the dominant smelting technology over the coming decades. Well-known benefits of AC furnaces are their reliable and efficient operation. DC technology is normally used in certain niche areas (such as FeCr fines, TiO₂ slag production) [4, 5]. Over the recent years, SMS has developed a next generation DC-smelter which aims at holding its position as the leading supplier in this field.

FENI-APPLICATION:

Ferro-nickel is mainly produced in submerged-arc furnaces by the reduction of nickel ores/calcline. The aim is to transfer most of the nickel into the metal phase. Good carbon distribution and specific slag metallurgy are important for a high yield. First, pre-heated and pre-reduced ores are hot-charged (at temperatures of up to 900 °C) into the furnace. Then, final nickel reduction takes place in the submerged-arc furnace. Ferro-nickel furnaces are semi-open stationary-type furnaces. Usually, round furnaces are used for smaller and medium quantities, whereas large capacities are produced in rectangular furnaces [6].

Milestones In 150 Years Of The Chemical Industry

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