Preface

The fate of stiff vacuum extrusion (SVE), this "ugly duckling" of ferrous metallurgy is playing out in a surprising way. In a brief and clear way and yet without being noticed, it has made its debut in the Bethlehem Steel blast furnace (BF) in the United States of America and has made a triumphant return, after almost 20 years, to the lineup of industrial agglomeration technology. Despite the fact that it would not be entirely accurate to compare the scale of the blast furnace operation of what was once one of the largest American steel companies and that of the small, Indian company Suraj Products Ltd (Rourkela, West Bengali), it is this same experience that has enabled the authors to mold SVE into a fully fledged metallurgical technology. Six years of experience of using briquettes in the charge of a small blast furnace in Rourkela served as the basis of the technical and economic foundation of a project to construct a briquette factory at the Novolipetsk Steel Plant, which is designed to produce 700000 tons of briquettes annually (the deadline for commissioning this plant is 2018). Over the course of all this time, the briquette manufacturing plant in Rourkela (in West Bengal) has been a peculiar kind of Mecca for metallurgists who specialize in the field of the briquetting of natural and anthropogenic raw materials. Blast furnace specialists from the Novolipetsk Steel Plant, the West-Siberian Metallurgical Plant belonging to EVRAZ, the Metinvest Group (in the Ukraine) as well as delegations from Paul Wurth, and Tata Steel and many other Russian, and overseas specialists have familiarized themselves with the work of the plant. We would like to express our gratitude to the owner of the Suraj Products Ltd Company Mr. Yogesh Dalmia who is a real enthusiast of extrusion agglomeration technology and contributed personally to the development of the 100% briquetted operation of small-scale blast furnaces concept.

Within the confines of the project to construct a manufacturing plant at the Novolipetsk Steel Plant, the possibility of a partial replacement of sinter in the charge of a blast furnace with extruded briquettes (brex) is under examination. The practical realization of this substitution requires a growth in the production of brex of several orders of magnitude. The benefits of this "peaceful coexistence" of SVE and agglomeration are obvious. The efficiency of the agglomeration process itself increases as a result of the removal of fines from the charge for sintering. If 50% of the sinter were replaced in the charge of a BF with brex, the basicity of the remaining sinter should be between 2.8 and 3.2. It is worth noting that given this basicity, calcium ferrite should predominate in the structure of the sinter, providing the increase of its strength. The results of a mathematical model of BF smelting using iron ore concentrate and coal brex with a carbon content in the brex of 9.5% demonstrated a high level of efficiency of a partial (by 50%) replacement of the production of sinter by the production of brex with a reduction in the coke rate of 15% and a reduction by 50% of the dust emissions, CO_2 emissions at the sinter plant will decrease by 32% and sulfurous gas emissions by 43% during the manufacture of the sinter.

In 2017, several brex producing factories for ferroalloys industry were constructed in different countries of the world. The design of all these factories, for the most part was based on the results of that, which is described in this book, including the methods for the preparation of the charge for extrusion agglomeration. The first smelts already confirmed the justification behind our recommendation for the brex as an effective charge component for submerged electric arc furnaces. The share of brex in the charge of such furnace can exceed 50% of the charge, and the resulting alloy is distinguished by its higher quality. At present, the possibility of using brex based on chromium-containing materials in the charge of direct current electric furnaces is being studied.

It would be unlikely that there would have been the growth in the popularity of stiff extrusion briquetting around the world, or the construction of new plants for the manufacture of brex, were it not for the systematic improvement of the technological characteristics of stiff extrusion, or the search for new binding materials, and the optimization of the operating conditions, and servicing of extrusion equipment. The only producer of the stiff extrusion briquetting equipment in the world is the J.C. Steele&Sons, Inc. (North Carolina). We experienced beginner's luck in researching the metallurgical properties of the extruded agglomerates. We are undoubtedly grateful to Mr. Richard Steele (Vice-President), who kindly made laboratory equipment of the Company available to us. Specifically, this relates to a unique computerized laboratory extruder that was able to model all the significant stages of SVE. We are grateful to Jim Falter for the comprehensive reports on testing of our customers materials in the lab.

The authors also consider it their duty to express their gratitude to Tatyana Malysheva, a known Russian scientist and one of the authors of metallurgical mineralogy, with whose cooperation it was possible to build the theoretical models on the nature of the hot strength of brex as they are heated in a reducing atmosphere. The successful spread of SVE in the ferroalloys industry became possible thanks among other things to cooperation with the known Russian scientists and metallurgists, V.Ya. Dashevskyi (of the A. A. Baykov Institute of Metallurgy and Materials Science of the Russian Academy of Sciences) and A.V. Pavlov (of the National University of Science and Technology, MISiS), for which we also express our gratitude.

Moscow, Russia Aitber Bizhanov

Springer

http://www.springer.com/978-3-319-72711-0

Stiff Extrusion Briquetting in Metallurgy

Kurunov, I.; Bizhanov, A.

2018, XII, 169 p. 133 illus., 81 illus. in color., Hardcover
ISBN: 978-3-319-72711-0