

The background of the cover features a row of cylindrical Li-ion batteries. The text 'LI-ION BATTERY' is printed vertically on each battery. A large, white, geometric shape, resembling a stylized 'X' or a series of overlapping triangles, is superimposed over the batteries. The overall color palette is dark blue and black with white highlights.

High Purity Alumina and Boehmite Market Research Report

Date: November, 2022
Author: Brendan Jephcott

Prepared by:

GOLDEN DRAGON CAPITAL

Table of Contents

Executive Summary.....	2
1.0 Introduction.....	19
1.1 Growth of New Energy Vehicle Industry	19
1.2 Lithium-Ion Battery Technology.....	21
2.0 Separator Preparation and Coating	25
2.1 Separator Properties	25
2.2 Separator Preparation	28
2.3 Separator Coating.....	33
2.4 Alumina Separator Coating Requirements.....	36
3.0 Cathode and Anode Coating.....	37
4.0 High Purity Alumina.....	38
4.1 Definition and Properties	38
4.2 HPA Production Technologies	40
4.2.1 Alkoxide Route	40
4.2.2 Choline Route.....	41
4.2.3 "Modified Bayer".....	42
4.2.4 Aluminium Chloride Hexahydrate (ACH) Process	42
4.2.5 Aluminium Solvent Extraction Process.....	43
4.3 Major HPA Producers (excl China)	44
4.3.1 Sumitomo Chemical Co., Ltd	44
4.3.2 Sasol Limited.....	45
4.3.3 Baikowski	45
4.3.4 Nippon Light Metal Holdings Co., Ltd	46
4.4 Major HPA Producers in China	46
4.4.1 Hebei Pengda New Material Technology Co., Ltd.....	46
4.4.2 Shanghai Gaona Industrial Co., Ltd.....	46
4.4.3 Zibo Honghe Chemical Co., Ltd.....	46
4.4.4 Xuancheng Jingrui New Material Co., Ltd	47
4.4.5 Dalian Hailan Optoelectronic Materials Co., Ltd.....	47
4.4.6 Yangzhou Zhongtianli New Materials Co., Ltd.....	47
4.4.7 Shandong Sinocera Functional Materials Co., Ltd	47
4.5 Potential HPA Producers.....	47
5.0 Boehmite	48
5.1 Definition and Properties	48
5.2 Boehmite Production Technology	49
5.3 Major Current Boehmite Producers.....	51
5.4 Anhui Estone Materials Technology Co., Ltd.....	53
5.4.1 Boehmite Business Unit Overview.....	54
5.4.2 Customers and Revenue	55
5.4.3 Cash Costs.....	56
5.4.4 Company Profitability	58
5.5 Nabaltec AG	59
5.5.1 Boehmite Business Unit Overview.....	62
5.5.2 Customers and Revenue	63
6.0 Boehmite Market Outlook	64
References	66
Disclaimer	70

Table of Figures

Figure 1: Tesla Model 3, Produced in Shanghai, China	19
Figure 2: China New Energy Vehicle Annual Production and Sales	19
Figure 3: EV-Type LIB Used in Electric Vehicles (Illustrative).....	20
Figure 4: EV-Type LIB Used in Electric Vehicles.....	20
Figure 5: Parts of a Lithium-ion Battery.....	21
Figure 6: Charging and Discharging of a Lithium-ion Battery.....	22
Figure 7: Schematics of inner structures of commercial Lithium-ion Batteries.....	24
Figure 8: Important performance properties of separators.....	25
Figure 9: Dry Processing Method to produce Separators.....	29
Figure 10: Wet Processing Method to produce Separators.....	30
Figure 11: SEM micrographs of microporous polyolefin membranes at the surfaces.....	30
Figure 12: (a) Surface and (b) cross-sectional scanning electron micrographs of a Celgard 2325 PP-PE-PP separator.....	31
Figure 13: Unit Price of Separator Material (unit x10,000 CNY) (1USD=6.76CNY).....	32
Figure 14: China LIB Wet and Dry Separator Production Output (2014-2020).....	32
Figure 15: China Wet and Dry Separator Material Market Share.....	33
Figure 16: China Coating Material Demand (inner ring is 2019, outer ring is 2020).....	36
Figure 17: Celgard Membrane Coated with 2 to 5 μm Thickness Ceramic Layers.....	36
Figure 18: HPA products on display.....	38
Figure 19: HPA Global markets	40
Figure 20: The Alkoxide HPA production route	41
Figure 21: The Choline HPA production route.....	42
Figure 22: HPA from Kaolin Schematic Flow Sheet	43
Figure 23: Alpha HPA Limited Solvent Extraction HPA production route.....	44
Figure 24: Boehmite Final Product.....	48
Figure 25: Estone Boehmite Principal Processing Flowsheet.....	50
Figure 26: Global Boehmite Market Company Share (2019).....	51
Figure 27: Estone Stock Price History, source Bloomberg	54
Figure 28: Estone factory in China.....	54
Figure 29: Distribution of Estone Boehmite Customer Revenue Share (2020)	55
Figure 30: Estone Boehmite Product Main Customers.....	56
Figure 31: Boehmite Cash Cost Distribution (2017 to 2020).....	57
Figure 32: Distribution of Estone Total Cash Cost per Tonne (2020).....	57
Figure 33: Distribution of Estone Manufacturing Cash Cost (2020).....	57
Figure 34: Boehmite Cash Cost and Unit Selling Price (2017 to 2020).....	58
Figure 35: Profitability Comparison of various Battery Material Companies (2018-2020).....	58
Figure 36: Estone Pole Piece Coating Sales Revenue.....	59
Figure 37: Nabaltec Stock Price History, source Bloomberg	59
Figure 38: Nabaltec Plant, Schwandorf, Germany.....	60
Figure 39: Nabaltec Organisational Structure.....	60
Figure 40: Nabaltec Global Business Layout Map.....	61
Figure 41: Nabaltec Product Segments	61
Figure 42: Anti-Shrinkage-Protection of PE-Separator via APYRAL® AOH 70 coating	63
Figure 43: Nabaltec Boehmite Revenues 2017 to 2021	63
Figure 44: Boehmite Demand and Market Size Forecast (2019 to 2025E).....	65

List of Tables

Table 1: Requirements for Lithium-ion Battery Separators	26
Table 2: Comparison of Dry and Wet Processing Methods to produce Separators.....	31
Table 3: Key Performance Indicators for Separator Coating Materials	33
Table 4: Mainstream Separator Coating Material Characteristics	34
Table 5: Performance Comparison of Inorganic and Composite Coating Materials	34
Table 6: Comparison of Putailai Coated Separator Products	35
Table 7: Example of HPA Product Chemical Specifications (purity ≥99.99).....	37
Table 8: HPA Key attributes and applications	39
Table 9: Classification of aluminium purity by country	39
Table 10: Major producers of HPA (excl China)	44
Table 11: Sumitomo High Purity Alumina Products	45
Table 12: Major producers of HPA in China	46
Table 13 : Potential producers of HPA	47
Table 14: Estone Boehmite Production Process List of Raw Materials and Consumption	50
Table 15: Estone Boehmite Production Process Aluminium Hydroxide Requirements	50
Table 16: Estone Boehmite Production Process Main Production Equipment	51
Table 17: Global Boehmite Market Company Ranking.....	51
Table 18: Brief Comparison of Boehmite Products used in LIB Separator Production	52
Table 19: Key Indicators of Boehmite for LIB Separator Material	52
Table 20: Boehmite Products from Various Companies	53
Table 21: Estone Boehmite Product Properties.....	55
Table 22: Nabaltec Boehmite Product Properties.....	62
Table 23: Nabaltec Boehmite Product Chemical Analysis	62
Table 24: Global Boehmite Market Size Forecast (2019 to 2025E).....	65