

MAGNESITE

Market Research Report

Author: Brendan Jephcott

Date: February 2023



Table of Contents

Executive Summary	2
1.0 Introduction.....	7
1.1 Industry Chain.....	8
2.0 Market Supply and Demand.....	10
2.1 Primary Magnesium Supply	12
2.2 Market Demand.....	14
3.0 Refractory Industry.....	17
3.1 Introduction	17
3.2 Principal Production Process.....	22
3.3 Commercial Products	26
3.3.1 Magnesite Products	28
3.3.2 Refractory Products.....	33
3.4 Financial Situation.....	35
3.5 Industry Competitiveness.....	43
4.0 Magnesium Alloy Industry	45
4.1 Magnesium Smelting and Cash Cost Analysis	47
4.2 Market Demand and Pricing.....	55
4.3 New Demand	62
References.....	71
Disclaimer	72

Figures

Figure 1: Magnesite mineral ore containing Mg (illustrative)	8
Figure 2: Magnesium-contained resources industrial chain.....	9
Figure 3: Fused magnesia produced from magnesite (illustrative).....	9
Figure 4: Magnesium oxide produced from seawater and brines (illustrative).....	10
Figure 5: Magnesium alloy produced from dolomite and magnesite (illustrative)	10
Figure 6: Distribution of global magnesite mineral reserves (thousand metric tonnes)	11
Figure 7: China magnesite reserves distribution	11
Figure 8: Global primary magnesium production (2014-2018).....	12
Figure 9: Global primary magnesium production (2021).....	12
Figure 10: China primary magnesium production (2014 to 2021)	13
Figure 11: Global primary magnesium production (excl. China).....	13
Figure 12: Distribution of magnesite downstream demand	14
Figure 13: Distribution of refractory materials downstream demand	15
Figure 14: China annual crude steel production (2010-2021)	16
Figure 15: China refractory material production (2012-2020)	16
Figure 16: Location map of Haicheng city in Liaoning Province, China.....	18
Figure 17: Donghe New Materials — main production base in Haicheng, Liaoning Province, China	19
Figure 18: Donghe New Materials — capital structure.....	19
Figure 19: Magnesite Flotation Concentrate Principal Processing Flowsheet	22
Figure 20: Magnesite flotation concentrate to light-burned magnesium oxide powder principal processing flowsheet.....	24
Figure 21: Fused magnesia principal processing flowsheet.....	24
Figure 22: Shaped refractory products principal processing flowsheet.....	25
Figure 23: Unshaped refractory products principal processing flowsheet.....	25
Figure 24: Donghe New Materials — main products and commercial applications	27
Figure 25: Donghe New Materials — electrical grade magnesium oxide raw material.....	28
Figure 26: Donghe New Materials — low-silicon and high-calcium fused magnesia	29
Figure 27: Donghe New Materials — large crystal fused magnesia.....	30
Figure 28: Donghe New Materials — concentrate light-burned magnesium oxide and tailings light-burned magnesia.....	31
Figure 29: Donghe New Materials — concentrate power after flotation	32
Figure 30: Donghe New Materials — Light-burned magnesium powder.....	32
Figure 31: Donghe New Materials — shaped refractory products.....	34
Figure 32: Donghe New Materials — unshaped refractory products.....	35
Figure 33: Donghe New Materials — business revenue by product.....	36
Figure 34: Donghe New Materials — business revenue by product (2022-H1)	36
Figure 35: Donghe New Materials — revenue of the three core products (2019 to 2022-H1)	37
Figure 36: Donghe New Materials — total revenue (2016 to 2022-H1)	38
Figure 37: Donghe New Materials — net profit attributable to the parent company	38
Figure 38: Donghe New Materials — exports of fused magnesia (2019-2021)	39
Figure 39: Donghe New Materials — expense ratio (2019 to 2022-H1)	42
Figure 40: Donghe New Materials — R&D center	43
Figure 41: Donghe New Materials — Average gross profit margin between the Company and the industry	45
Figure 42: Magnesium ingots.....	46
Figure 43: Magnesium steering wheel	46
Figure 44: Magnesium industry chain	47
Figure 45: Development history of magnesium smelting technology.....	47
Figure 46: Prices of main raw materials ferrosilicon and thermal coal	48
Figure 47: Pidgeon process for magnesium smelting	49

Figure 48: Horizontal tank regenerative magnesium reduction furnace.....	50
Figure 49: Vertical tank regenerative magnesium reduction furnace.....	51
Figure 50: Price trend of primary magnesium price trend (2021).....	56
Figure 51: Reasons for the price trend of primary magnesium in 2021.....	56
Figure 52: Price trend of primary magnesium in 2022.....	57
Figure 53: Average cost and profit curve of domestic primary magnesium enterprises in 2022.....	58
Figure 54: Comparison of monthly output of magnesium ingots in China in 2021-2022.....	58
Figure 55: Comparison of monthly operating rate of magnesium ingots in China from 2021 to 2022.....	59
Figure 56: Comparison of China's monthly exports of magnesium ingots from January to August 2022.....	59
Figure 57: Corresponding countries for magnesium ingot exports from January to August 2022.....	60
Figure 58: Comparison of monthly production of magnesium alloys in China in 2021-2022.....	60
Figure 59: Comparison of monthly operating rates of magnesium alloys in China from 2021 to 2022.....	61
Figure 60: Forecast of China's magnesium production in the second half of 2022.....	61
Figure 61: Comparison of energy-saving potential of different technical measures.....	63
Figure 62: Vehicle Lightweight Technology Path.....	64
Figure 63: Development History of Magnesium Alloys.....	65
Figure 64: Weight of some magnesium alloy auto parts.....	66
Figure 65: life cycle of lightweight materials.....	66
Figure 66: Vehicle Lightweight Technology Path.....	67
Figure 67: Xingyuan Zhuomei Gearbox Assembly Housing.....	69

Tables

Table 1: Magnesium-contained natural resources.....	7
Table 2: Different types of magnesium smelting require different upstream raw materials.....	8
Table 3: Supportive industry development policies of the Chinese government.....	17
Table 4: Description of magnesite flotation concentrate principal processing flowsheet	23
Table 5: Magnesite concentrate industry product standard (Source: YB/T 4065-1991).....	23
Table 6: Description of magnesite concentrate to light-burned magnesium powder principal processing flowsheet.....	24
Table 7: Description of fused magnesia principal processing flowsheet.....	24
Table 8: Description of Donghe New Materials main products.....	27
Table 9: Donghe New Materials — concentrate power after flotation	32
Table 10: Donghe New Materials — shaped refractory products.....	33
Table 11: Donghe New Materials — gross profit margin structure	39
Table 12: Donghe New Materials — magnesite business gross profit margin	40
Table 13: Donghe New Materials — Fused magnesia and light-burned powder business gross profit margin ..	40
Table 14: Donghe New Materials — refractory products business gross profit margin	40
Table 15: Donghe New Materials — average unit sales price of product portfolio	41
Table 16: Donghe New Materials — Core technologies used in the Company's production process	44
Table 17: Progress in Metal Magnesium Smelting Technology	50
Table 18: Comparison of energy consumption parameters related to salt-lake electrolysis method and Pidgeon method	52
Table 19: Comparison of magnesium smelting process equipment and technology.....	52
Table 20: Comparison of carbon emissions between the Pidgeon method and the thermite method.....	53
Table 21: Comparison of magnesium smelting process parameters and production costs.....	54
Table 22: Energy consumption comparison of magnesium smelting process (kW·h/t).....	54
Table 23: Magnesium alloys in downstream applications	55
Table 24: China's magnesium ingot production capacity and output distribution in 2020 (10,000 tons)	62
Table 25: Weight reduction of lightweight materials.....	64
Table 26: Weight reduction of lightweight materials	64
Table 27: Situation of major domestic manufacturers of magnesium alloy auto parts.....	66
Table 28: Application of Magnesium Alloys in Auto Parts	67
Table 29: Weight of some magnesium alloy auto parts	69
Table 30: China's lightweight technology development roadmap planning.....	70
Table 31: Market Size of Magnesium Alloy Auto Parts.....	70