Research on the Application of New Model of Intelligent Manufacturing in Aluminum Industry

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Abstract: Through the analysis of the problems faced by the aluminum industry in China, the necessity of introducing a new model of Intelligent Manufacturing in aluminum industry is put forward. Taking M aluminum industry as an example, this paper expounds the new mode of Intelligent Manufacturing in modern aluminum industry from several aspects, such as application goals, application difficulties, intelligent manufacturing system architecture and architecture design ideas.

1 INTRODUCTION

With the development of lightweight transportation, new generation of electronic information industry, new energy vehicles, high-end equipment manufacturing, energy saving, environmental protection and other strategic emerging industries, the demand for aluminum market is increasing year by year. However, the competition of the aluminum industry is fierce, the high-end products are few, how to improve the comprehensive competitiveness of the enterprises, the introduction of the new intelligent manufacturing model is inevitable. Based on the equipment and production line automation, intelligent transformation of the new mode of intelligent manufacturing, construction of "unmanned workshop", to promote the transformation of the mode of production to the intelligent, flexible, fine; new type mould industry through the establishment of industrial data analysis, optimization and "Internet plus" collaborative manufacturing, to enhance the research and development, production, management, marketing and service of the whole process of the level of intelligence, improve labor productivity, reduce the cost. Taking M aluminum industry as an example, this paper expounds the construction of a new intelligent manufacturing model for aluminum industry.

2 PROBLEMS OF THE ALUMINUM INDUSTRY

China's aluminum industry is developing rapidly, but compared with the world powers, there are still some gaps in technological innovation, industrial structure, quality and efficiency, green development and resource protection.

(1)The ability of technological innovation is insufficient. Basic common key technology, deep processing technology and applied technology research and development are inadequate. Aluminum products generally have poor quality stability and high cost, and some high-end aluminum products still rely on imports.

(2) Structural contradictions are prominent. The concentration of aluminum industry is low, and the strength of the enterprise is weak. The production line of high end processing line is generally not high, the middle and low end processing products are homogenized and the market competition is out of order. At the same time, with the further standardization and development of the aluminum processing market, the high-end products market will gradually change to new energy materials and functional materials such as aluminum foil for lithium batteries, automotive aluminum and so on, and will become a major trend of future development.

(3) The upstream and downstream constraints are uncontrollable. The concentration of aluminum industry is low, and the cooperation between upstream and downstream is insufficient, and it is affected by the fluctuation of the upstream and downstream industries and the operating environment. The superposition of multivariable in the process of production leads to the bottleneck of the precision of the process standard for the whole process of production.

(4) Industry transformation is difficult. The aluminum industry has extensive production mode and low production efficiency. It is labor intensive, resource consumption is large and product homogenization is serious, resulting in low profitability. All of these restrict the development of China's aluminum deep processing products. At present, there is a big gap with the international advanced production level at present. The promotion and application of new technology, new technology and new equipment still have a long way to go, and the transformation of the whole industry is difficult.

In the whole industry inefficient allocation of resources, lack of technological innovation ability under such circumstances, China's high precision aluminum must conform to the new round of technological revolution and the industrial revolution opportunities, accelerate the intelligent manufacturing, networking, big data and other information technology and manufacturing integration, increase the machine substitutions and production control applications such as efforts to promote production change the way to intelligent, flexible, fine; carry out the construction of public service platform and energy control center, R & D system, information system, operation management system, integrated enterprise; gradually promote industrial software, data management, engineering services, technical standards of resource sharing and cloud application services, the establishment of the "new industrial model Internet plus" collaborative manufacturing, accelerate industrial restructuring and upgrading.

3 NEW INTELLIGENT MANUFACTURING MODEL

3.1 New Model Application Target

The application of a new model of the intelligent manufacturing, accelerate the intelligent plant construction, set up production plan, process coordination, equipment control, resource optimization, quality control and decision support intelligent integrated control platform to achieve high precision aluminum production, fine, intelligent man-machine and optimize the allocation of resources, accelerate enterprise data sharing, improve production and management efficiency and promote the technology innovation continuously, realize the enterprise management, to strengthen industrial cooperation.

(1)Speed up data sharing

M aluminum through the introduction of a new model of intelligent manufacturing, so in terms of planning, scheduling, production, research and development, business operation and market development, to realize people and people, people and equipment between the highly cooperative and information group, point to the opposite point of the real-time transmission, integration, sharing, and small batch and large-scale production needs full customization of M aluminum.

(2)Improving enterprise efficiency

M aluminum through the construction of intelligent control platform, constantly optimize the lean production mode, real-time control of material consumption is minimized, reduce the manufacturing process and the loss of inventory; optimization of supply chain system, and effective control of suppliers and customers the cost of space, achieve both effective coordination, improve logistics efficiency of materials and products, reduce inventory cost three each between.

(3)Promoting continuous innovation

M aluminum manufacturing technology, networking and cloud computing, big data, as the representative of information technology to accelerate the integration and innovation, the construction of intelligent plant, promote the automatic data acquisition system, simulation and analysis of large enterprises to make full use of data in real time or virtual scene, effectively activate the innovation potential, innovation mode, efficient and quickly respond to the market, leading the industry, enhance the market competitiveness of enterprises.

(4) Strengthening industrial coordination

M aluminum to intelligent plant for the direction of development, carry out the application of a new model of intelligent manufacturing, through e-commerce, big data, cloud platform, the response of downstream users customization, processing and distribution requirements, established from the early intervention (EVI) to the full user technical support and service system to promote win-win, service-

oriented manufacturing manufacturing, business model innovation, improve value-added service.

3.2 New Model Application Difficulties

When the new model of intelligent manufacturing is introduced in M aluminum industry, many difficulties are encountered, which are mainly embodied in several aspects.

(1)Hard hardware integration

The process of aluminum production involves the types, quantities and interfaces of the equipment, the complex process of the section and the great difference in the process. It is difficult to integrate and control the equipment of each section and collect electronic data in an all-round way to form a line of industrial automation. It is necessary to cooperate fully and comprehensively with the relevant people, things, technology and so on. In addition, the M aluminum part of the equipment is obsolete and needs to be replaced or modified to provide conditions for intelligence.

(2)Difficult data acquisition and transmission

The intelligent manufacturing process requires centralized control of the control system in all processes to improve the industrial bus. M aluminum industry needs to improve the intelligence level of some energy metering instruments to ensure the stability of data collection. It is necessary to unify the interface modes of each machine and equipment. It is necessary to unify the version of every software system to ensure the coordination between database and function, so as to ensure unified management and protection. The internal communication of the enterprise needs to further improve the industrial Ethernet and achieve the stable transmission of the data of the control system.

(3) Difficult software integration

It is difficult to integrate the intelligent manufacturing management and control system of M aluminum industry. It is necessary to connect with the data and process of R & D design system, formula system, raw material detection management system, and need to form synergistic control with supply chain. The need to achieve and the production process and process standardization management system docking, ensure the realization of process in strict accordance with the provisions of the file, effectively control the deviation of the specific implementation (such as credit, price etc.), real time tracking, contrast analysis (such as ingredients, quality), get the corresponding results, efficient operation, standardized management system.

(4) Difficult data coordination

It is difficult to standardize the main data encoding of M aluminum industry. We need to improve the convenience of data viewing in production process, and we need to integrate product coding from smelting, casting rolling to packaging process to ensure the uniqueness of product coding.

The scientific data report of M aluminum industry is difficult. If we want to improve the utilization rate of system reports, reduce or even eliminate the manual processing ratio of workshop reports, and enhance the real-time data, we should integrate reports and unify the reporting caliber and calculation standard, so as to make meticulous management.

It is difficult to standardize the BOM database of M aluminum industry. Need to use system management tools, improve the main materials, alloy configuration, process parameter control, coordinate with production and business; information tools need to establish security, establish the BOM configuration list, according to the authority of special control, implementation and material consumption, intelligent workshop, supply chain collaborative business system and job shop Control Co.

3.3 Construction of Intelligent Manufacturing System

(1) General architecture of intelligent manufacturing system

Based on industry 4, intelligent plant system, key features and core technologies, M aluminum enterprise designs and implements a new intelligent manufacturing mode combined with its own needs. The overall architecture is illustrated in Figure 1. System design in accordance with the "overall planning and implementation of distribution" principle, the production equipment from the equipment intelligent, intelligent, intelligent management, research and development of intelligent and multi dimension data integration and optimization analysis, based on the "Internet plus" supply chain and industry chain interconnection, expansion design and implementation.

The smart factory from the platform layer, professional production level, operations control, strategic control layer, intelligent application support M aluminum intelligent manufacturing system to achieve synergy, transparent management of production preparation process, the interconnection of intelligent equipment, intelligent manufacturing resource management, research and production of

supply and marketing integration, intelligent decision support. Analysis and optimization of dynamic operation, to achieve a full range of production process management and intelligent control.

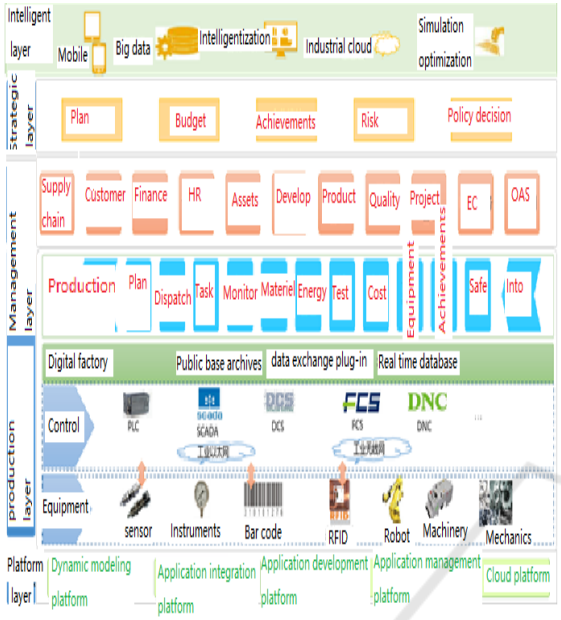

Figure 1: Architecture of M aluminum industry Intelligent Manufacturing System.

Platform layer: the technology platform based on SOA and ESB supports the construction of all stages of the whole intelligent factory. The platform layer includes dynamic modeling platform, application integration platform, application development platform, application management platform, and cloud technology running platform.

Professional production: through digital factory platform, the integration of equipment, control system and production execution system is realized, and digital factory is established to realize intelligent control in production process. The digital factory platform through the plant modeling tools, establish factory digital model, through equipment integration and data integration technology to all levels of data integration between systems, and integrated automation equipment, establish intelligent plant data acquisition and monitoring; production implementation work order planning, scheduling, production, inspection of the whole process of closed loop management, acquisition, production schedule site operation, quality inspection, production equipment state information, realize the visualization of the production process and traceability.

Management and control layer: to achieve enterprise R & D, supply chain, customer relationship, finance and other business management and control, establish e-commerce collaborative platform, realize supply chain upstream and downstream synergy, ensure production, logistics, supply and production synergy.

Intelligent application layer: through continuous improvement and optimization technology, realize the operation of dynamic process optimization, manufacturing and management information sharing, full transparent, with big data, cloud computing enterprise intelligent management and decision making, enhance the enterprise resource allocation optimization, automatic operation, real-time optimization, sophisticated and intelligent production management the level of scientific decision-making.

(2) The design idea of intelligent manufacturing system

Planning and design in accordance with industrial 4 and intelligent manufacturing elements. From the analysis and optimization of collaborative development of intelligent, intelligent production, intelligent storage, intelligent supply chain system, intelligent management, intelligent customer and industry data, to develop and implement transparent preparation for production in the process of collaborative management, intelligent equipment interoperability, resource management, intelligent production research and production supply and marketing integration, decision support analysis and optimization of intelligent data, thus, to reach full production process management and intelligent control. M aluminum intelligent manufacturing project implemented in three phases, MES system, material logistics, supply chain collaborative commerce implementation of the first phase of the implementation of the production process, transparency, visualization and supply chain cooperation; research and development management, the implementation of the second phase of intelligent warehouse, device control, implementation of developing and manufacturing integration, intelligent storage management and process control third equipment; implementation of automatic scheduling, online optimization, intelligent analysis of large data, intelligent applications, big data analysis and optimization of intelligent manufacturing.

(3)Network architecture of intelligent manufacturing system

The M aluminum industry system uses B/S and C/S architecture, which is mainly used in the internal

management of the enterprise. The network includes two parts of the online LAN and the wireless LAN. The system network architecture is shown in Figure 2.

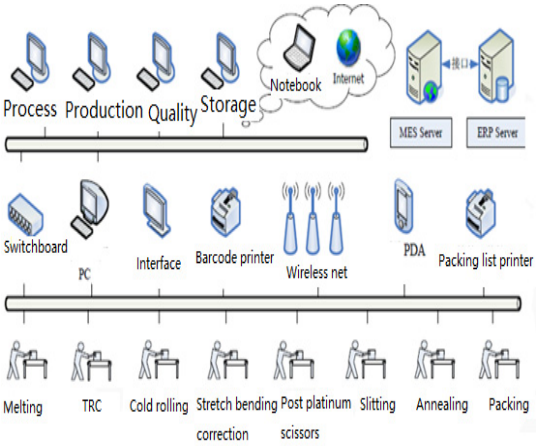

Figure 2: Network architecture of M aluminum industry Intelligent Manufacturing System

3.4 The Intelligent Embodiment of the New Model

(1) Intelligent research and development

The M aluminum industry intelligent manufacturing system can carry out new product research and development according to the new customer needs. The new product materials BOM, formula, process route and production guidance are planned. The new product is formed, from the basic data of R & D system or PLM MES system to transfer material definition, BOM, process route for production, MES system planning and scheduling, production scheduling based on P-BOM data, at the same time in the production process of abnormal feedback to the R & D department. The R & D department optimizes the product formulation and design plan, and realizes the synergy and integration of data and process between R & D and manufacturing, so as to shorten the product development cycle and improve the accuracy of production and delivery.

(2)Intelligent production

M aluminum in intelligent manufacturing system, MES system implementation of production plan scheduling and monitoring and scheduling, from procurement, inventory, production and sales to the barcode /RFID management of financial management, the use of bar code acquisition /RFID melting, casting, rolling, bending straightening, cutting, slitting, thick foil annealing, cutting process the production and packaging material input, quality information, process parameters and production process data, and workshop condition real-time monitoring and adjustment, can achieve flexible production, MES system to realize data acquisition, error proofing, leakage alarm and process quality control, materials, personnel, technology and other courses, traceability. The running state of accurate perception of enterprises, workshops, equipment, system; execution plan decision of equipment, workshop and production lines to make adjustments; fast and accurate processing, recognition and processing of real-time state data acquisition; judgment and choice according to the results of data analysis according to the rules set automatically make the final. The plant state perception, precise execution, real-time analysis, decision-making.

(3)Intelligent logistics

M aluminum intelligent manufacturing system, the introduction of advanced barcode and wireless communication technology in the warehouse management, on arrival inspection and warehouse storage, transfer, transfer bank transfer, inventory and other each work link data acquisition automation, ensure the accuracy and efficiency of the warehouse management of the operation part of data input, and can be integrated with ERP system, ensure the real data and ERP timely and accurate access to inventory, and maintain a reasonable control inventory. Through scientific coding, it is also convenient to manage the batch and shelf life of the goods. Barcode technology WMS is a way to achieve modern warehouse management. It is a way to ensure warehouse operation optimization, make full use of warehouse space, reduce operation cost, improve agility and increase business efficiency.

(4)Intelligent management

As the core business system of the enterprise, intelligent management is also the most basic information system. To achieve the comprehensive management of people, money and things, M Aluminum Group has established a complete ERP system based on group management and control, including financial accounting, supply chain, human resources, production orders, equipment management and so on.

(5) Intelligent customer collaboration

M aluminum industry is built on the core of CRM/MRO based customer collaboration, aiming at building the whole life cycle management of customers, and building a unified, complete and cross sectoral global view of customers, so as to achieve seamless transfer of customer information from market, sales to customer service team.

Through the customer relationship management system, every employee who faces customers can get effective sales information in time and accurately, get the information needed for high-quality customer service, improve the core competitiveness of enterprises, and achieve the goal of rapid growth. The entire business process of an enterprise, including judgment, selection, struggle, development and maintenance, is truly customer centered.

(6)System integration scheme

M aluminum intelligent manufacturing system, through integration with ERP, MES, PLM, SCM and other systems, establishes a unified data center, and collects real-time data collected from each section and the control system of the public system on the smart factory platform. A monitoring platform covering the whole company's production and operation is established to achieve the whole process tracking of sales orders, production process tracking, production scheduling optimization scheduling and product quality management traceability. Real time collection and centralized storage of production data are realized. To improve the enterprise's resources allocation optimization, operation automation, real-time online optimization, production management refinement and the scientific level of intelligent decision-making.

(7) Large data analysis and optimization

M aluminum industry intelligent manufacturing system, integrated production, supply, marketing, storage and other large industrial data, and to carry out analysis and optimization.Based on the data collection, data management, data analysis, knowledge, wisdom "of the whole process of ideas and principles, M aluminum intelligent platform, through the establishment of a unified central data center, a large set of material procurement, sales, production, real-time, management, human resources and financial data. Through the data mining technology such as OLAP, the data is fully excavated and analyzed. According to different management priorities, management levels and management dimensions, we carry out professional analysis, performance analysis, benchmarking analysis and problem analysis for all stages of business, so as to identify problems, intelligent decision analysis and promote management.

4 CONCLUSIONS

The M aluminum industry introduces a new model of intelligent manufacturing. The core of intelligent equipment, data acquisition, analysis automation, system integration, "Internet plus" collaborative manufacturing, to achieve the customer customization B2M production mode, improve the technical and economic benefits of enterprises, improve the social benefits. Through the "intelligent production equipment", "logistics and transport material recognition accuracy", "product development cycle", "production scheduling accuracy", "production efficiency", "single" productivity ", the rate of finished products", "product defect rate", "tons of foil energy consumption and other indicators in the comparison system to enhance the rate before and after the implementation of the actual proof of the superiority is obvious, the introduction of a new model of M aluminum, is similar to.

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