

Vision for Welding Industry in China

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1. Introduction

Welding is considered as one of the most cost effective joining technology. Up to now, there is no other joining process commonly used as welding which adds high-value into products and pervades varied engineering and manufacturing. Today's welding technology has been developed to a comprehensive science covering materials, mechanics, metallurgy, electronics and automatic control techniques.

Chinese welding industry incorporates the enterprises, companies, institutes and other organizations that uses welding technologies and/or provide equipment, materials, processes and support services for welding.

The total steel consumption reaches to 14.1 billion tones last year in China, and more than 40% of the steel applies to welding structures. At present, welding technology has been used as the major joining technique in many manufacturing industries on which the product quality rely on welding in large measure. Those industries include: automotive, heavy machinery, construction engineering, communication, aerospace, electric and nuclear power, petrochemical, electronics, medical products and precision instruments.

2. Main organizations

There are several organizations playing important roles in Chinese welding industry. Chinese Welding Society (CWS) found in 1962, is a national academic organization and the official IIW member society in China.

CWS services more than 20,000 members all over the world. Its membership consists of engineers, scientists, educators, researchers, welders, inspectors, welding foremen, company executives and officers, and sales associates. Interests include automatic, semi-

automatic and manual welding, as well as brazing, soldering, ceramics, lamination, robotics, safety and health.

China Welding Association (CWA) found in May 1987, is a welding trade organization and nonprofit independent corporation in China. It consists of 710 member bodies with a rate of 86% industry enterprises and 14% research, education bodies involving welding.

Chinese Committee for Welding Standardization (CCWS) was found in June 1985. The organization is under the lead ship of China State Bureau of Quality & Technical Supervision (CSBTS) and takes the responsibility of national standardization affairs concerning welding. The technical scope and field engaged by the organization are equivalent to that of ISO/TC44.

Harbin Welding Institute (HWI) was found in 1956. It has become the largest and unique national comprehensive research body concerning welding in China. The institute carried out more than 500 research programs in the past 40 years with regarding to subjects on behaviors of welded metallic materials, welding technique for welded structure, new welding consumables, welding technology and equipment, welding automation and control welding robot application, surfacing processes, thermal cutting, NDT technique etc. Besides of engaged in welding research and development, the institute also play an important role in welding industry by undertaking the secretariat tasks of CWS, CWA and CCWS. The two national quality supervision and test center for welding consumable and cutting machine & tool are also located in the institute.

Harbin Institute of Technology (HIT) is one of the universities engaged in welding education with the longest history in China. The unique national key laboratory concerning welding techniques was found in the university.

Harbin Welding Training Institute, the largest organization for welding training, was established in the middle of 1980s under the background of Sino-Germany government collaboration frame. The institute has acquired international ATB authorization since 1999 and trained more than 1500 persons in accordance with IIW training programs.

3. Current Situations

3.1 Welding Consumable

At present, more than several hundreds enterprises have engaged in welding consumable manufacture. According to the statistics, total production of welding consumable (including electrodes, wires and flux) in last year had grown up to 1.1million tons (Table 1 and Fig. 1) in China.

● Covered Electrode

At present, nearly 500 manufactures produce about 460 classifications of covered electrode. The total production of the covered electrode had continuously keep in 900,000 tons in recent two years with 100,000 tons of them being export to 40 different countries and areas.

Table 1 Welding consumable production situation in China

	Manufacture number	Production (in ton)	Percentage (%)
Electrodes	About 500	900,000	78~79%
Solid wires for GMAW	Over 150	110,000	10%
Flux cored wires for GMAW	28	0.4	0.33%
Wires for SAW	About 200	50,000~60,000	5%
Flux	About 30	70,000~80,000	6%
Total		About 1100,000	100%

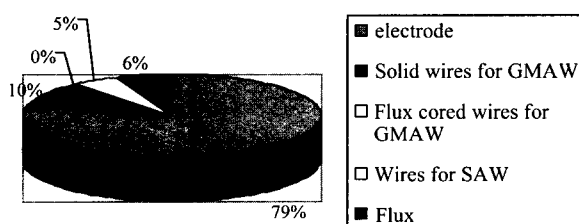


Fig. 1 Welding consumable constitution in year 2000

● Solid Wires for Gas Shield Arc Welding

More than 150 enterprises engage in manufacture of the solid wire in the country. Nearly 50 sets of the equipment in making solid wire were imported from oversea, and the 150 domestic production lines get into service meanwhile. The capacity of solid wires has been up to 300 thousands ton annually by increasing the production 20 times of that 15 years ago.

● Flux Cored Wires

In the 1980's, the first foreign flux cored wire line was introduced into China under the background of implementing high effective welding in shipbuilding, and 28 enterprises start importing other 20 lines from UK, USA, Japan, Ukraine, Germany and Italy in 1993. In addition, 18 lines made in China have also been put in service. Therefore, the annual capacity of flux-cored wire grows up to 20,000 tons. However, the annual production is still at a low with the amount of 4000 tons in 2000.

● Wires and Flux for Submerged Arc Welding

The number of flux manufactures is more than 30, and the consumables for SAW also takes a quite low rate by 10~12%. The total sum of consumables is near to 12,000 tons last year with 5000~6000 tons of wire and 6000 tons of flux respectively.

3.2 Welding equipment

Chinese welding equipment industry is facing a baptism. One of significant evidence is that the number of welding equipment enterprises has reduced sharply in recent years by 1500 ages ago to 900 nowadays. Nearly 20% of the enterprises resigned last year and some of others leave from this field by means of changing production, stopping production, production reform.

Current welding equipment classifications consist of arc welding machine, auto/semi-auto welding machine, resistance welding machine, and special & set equipment. One statistics indicates that: arc-welding machine take the majority of near 70% and auto/semi-auto welding machine take the second position by 23%, which is shown in table 2.

The market share in recent years approximately divides two parts by imports and domestics respectively taking 55% and 45 % (Fig. 2).

Table 2 Statistics for Welders of Some 85 Manufactures in 1999

Product type	AC Arc welder	DC Arc welder	Auto/semi auto welder	Special Welding equipment
Quantity	78216	23096	34444	6234
Percentage	51.7%	15.3%	22.8%	4.1%
Total	151356			

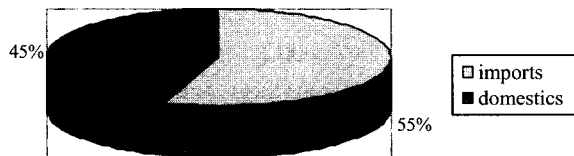


Fig. 2 Chinese market distribution involving in welding equipment

3.3 General tendency prediction

Compare with some advanced country and area, China still have long way to go for adjusting its unreasonable structure of welding industry. It was prognosticated that the Chinese welding consumable constitution would take changes in evidence by the characteristics of electrodes for manual arc welding reducing while the consumables for GMAW increasing and the consumables for SAW keeping constant (see table 3).

Corresponding to the changes of consumables, there will be some varieties on equipment with a general tendency of decreasing AC arc welders and increasing auto/semi-auto welders and special equipment.

Table 3 Welding consumable constitutions in future

Year	Electrodes	Solid wires for GMAW	Flux cored wires for GMAW	Wires and flux for SAW
2005	65%	20%	3%	12%
2010	50%	30%	10%	10%

4 Industrial demands

4.1 Demands to welding consumables

● **Electrodes for long distance pipeline:**

The cellulose electrode is commonly used in pipeline welding. Currently most of the electrodes, such as E6010, E7010 and E7010-G were imported from USA, Japan and Austria. With the start of the project of 'gas transmission from west to east', the demands

will be increased by a consumable of importing 3000 ~ 5000 tons each year.

● **Stainless electrodes**

China consumes stainless steel by increasing 15% annually since 1995. According to the stainless steel consumption of 1.7 million tons in year 2000, it is estimated that China will need stainless steel 2.3 million tons in 2005 and 2.65 million tons in 2010. That means China will consume stainless electrodes 1000 or 1500 tons more annually on the bases of 11000 ~ 12000 tons in last year.

● **Solid wires for GMAW**

Solid wires for GMAW were rapidly promoted in China due to the high efficiency, perfect quality and reasonable price. One of the major problems is limited variety. More demands will put forward to different steels including high strength steel, low temperature steel, heat resistance steel and corrosion resistance steel.

● **Flux cored wires**

Flux cored wires were still under the start phase in China. Flux core wire was most commonly used in shipbuilding, metallurgy and construction industries but it has an amplitude market foreground on other industries including heavy machine building, pressure vessel, petroleum & chemical, pipeline, offshore construction etc.

4.2 Demands to welding equipment

In accord with the steel capability of 130 million tons last year in China, it is analyzed corresponding requirements to welding equipment will be 260,000 sets, in which AC welders, DC welder, auto/semi-auto welder resistance welder and special equipment take the proportions of 55%, 17%, 16%, 7.5% and 1.5%, respectively.

● **Automobile industry**

Its requirements to welding equipment commonly lay on three aspects: high efficiency, high reliability and control system with high flexibility. Resistance welding machine is most used in automobile industry, and the requirement to portable spot welder may be more increased.

● **Ship building industry**

Ship building requires the equipment ensuring

welding quality, promoting working efficiency and improving working conditions. It must also be suitable to long distance operation with the characteristic of energy saving.

● **Power station and boiler industry**

Welding is a main process during the power station or boiler manufacture. The welding equipment usually is required to:

- Provide perfect welding quality with strict demands to the stability of welding procedure;
- Convenient for consisting a producing line;
- Have good suitability to different steels and easy to adjust welding parameters;
- Be able to monitor, track and compensate automatically during welding.

● **Other industries**

There are also similar requirements to welding equipment in other industries such as, machinery, metallurgy, construction, chemical, petroleum, transportation, etc.

One industrial investigation gives a brief description on actual demands to welding machine in next a few years.

- AC arc welder will still be majority, but its needs in automobile, boiler productions are limited. In shipbuilding, AC arc welder may take a high proportion due to the small cubage, light weight, and big capability;
- DC arc welder will take second place in market, the main requirements are reliable quality and perfect functions;
- CO₂ welder will continues increased in industrial needs provided that good property, high reliability and quality. Main attention will focus on less spatter and good weld form;
- Submerged arc welder is commonly applied. Excepting for its power and control system, further requirements to the device for calibrating, flux recovering and operating will also be needed.
- Resistance welder mainly applies to automobile manufacture, special necessary is to the portable spot welder;
- Special welder includes friction welder, electron beam welder, laser welder, braze welder and plasma arc welding & cutting machine which will be needed in different industries;
- Welding equipment set will expand rapidly due to low cost, high efficiency and perfect welding quality.