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## Short communication on the development orientation of shipbuilding in Vietnam

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### Abstract

Although sea transport is a natural infrastructure-based industry, it needs a significant contribution from the shipbuilding industry. In order to have big and stable ships, they will go to sea with long journeys and big lots of goods. The following article will introduce the shipbuilding industry in Vietnam today. According to statistical reports, Vietnam now has about 120 factories to repair and repair ships with a tonnage of over 1,000 tons, with 170 lifting and lowering works. The total design capacity of factories is about 2.6 million tons/year, but the actual capacity is only 800,000-1 million tons/year. Since 2002, Vietnam's shipbuilding industry has been heavily invested. However, it is only in the process of receiving transfer from major shipbuilding centers in Asia. Vietnam is one of the 10 countries with the highest index of coastline in the East, South and Southwest. With these characteristics, we have always been identified as the most favorable position in the region in developing shipbuilding industry. Not only natural conditions but also Vietnamese policies support the development industry. By 2020, Vietnam has determined that the marine economy is a driving force to entice and promote other economic regions to develop. Thereby creating a fundamental and comprehensive transformation of the marine economic structure towards industrialization and modernization. An important step to implement the Marine Strategy by 2020 is to develop shipbuilding and shipbuilding industry. Not only that, currently, the demand for shipping by sea also increases, so the shipbuilding industry will have many opportunities for the market.

**Keywords:** maritime industry, shipbuilding, development

### 1. Introduction

Maritime-related business activities are projected to account for 50% of Vietnam's economic output by 2020, as the volume of seaborne trade will triple. Under the new master plan on development of Vietnam's seaport system to 2020, with the orientation towards 2030, the Government of Vietnam is promoting the participation of foreign investors in the development of seaports, and encourage businesses to invest in the industry. The government recently announced a plan to develop the country into a strong maritime nation by 2030, in areas such as security, tourism and fishing. Accordingly, many trade agreements are expected to be signed between Vietnam and other countries in the coming years, but the number and capacity of the existing 120 ports is not enough for economic growth. Besides, with an average annual export growth rate of 12%, Vietnam's port infrastructure needs to grow more. Specifically, Vietnam's maritime industry requires the latest technology and solutions to facilitate such development. So we continue to organize the INMEX Vietnam 2019 to connect demand with supply in Vietnam's maritime industry. In some industries such as shipbuilding, rig construction, oil and gas, mechanical engineering, stainless steel welding plays a very important role. However, in practice stainless steel welds, especially the link between stainless steels and structural steels, are commonly encountered with the following problems: 1) Due to differences in crystalline structure, atomic diameter, solubility and diffusion of solid and liquid metals, etc., the mechanical durability, plasticity Weld joints when applying conventional welding technologies. Therefore, the welding of stainless steel with structural steel is considered to be much harder than other welding joints; 2) In the welding of stainless steel with conventional structural steel, there is a lot of residual stress, thermal stress leads to appearance of defects such as deformation, cracking of the surface,

cracking due to stress corrosion. This is also the most worrying issue in manufacturing plants. According to research findings, there is little scientific research involved in finding the causes and remedies for these phenomena. The quality and longevity of the marine equipment are quite high in relation to the quality of the welds, especially the welds between the layers. One of these forms is the weld of stainless steel with carbon steel. However, the current focus in the country to provide welding technology, not to focus on welding technology to improve the quality of welding. In addition, the research and manufacture of test equipment heat treatment welding is not properly concerned. Metals are materials with properties that are conducive to construction: high strength, flexibility and high fatigue resistance. As a result, metal is widely used in construction and other engineering industries. In its pure form, due to its low strength and stiffness, high plasticity, and limited use of metals. They are used primarily in the form of metal and non-metal alloys, such as carbon. Its iron and alloys (steel and cast iron) are called ferrous metals; the

remaining metals (Be, Mg, Al, Ti, Cr, Mn, Ni, Cu, Zn, etc.) and their alloys are called non-ferrous metals. Depending on the use and conditions of use of the metal structure, the importance of the home and the building is the use of different types of steel to withstand the different temperatures of outdoor air. The rapid development of modern industry has led to the tremendous demand for materials while simultaneously having many of the same properties that materials such as metals, ceramics and polymers stand apart. Durable, lightweight, low cost, high corrosion resistance. Composite (or combination of materials), which has met the requirements of recent decades, has responded, applied and developed to a high level in the law of association - a universal law. Variable in nature. Composite science and technology has been used extensively in everything from aeronautics to orthopedic materials and has grown to such an extent that many people believe that the 21st century will be the composite civilization.



**Fig.1:** Shipbuilding industry in Vietnam

The plan also clearly stated the objectives of the Vietnam Marine Strategy to 2020, the maritime economy ranked second and after 2020 the leading maritime economy in the 5 areas of marine economic development; at the same time, it also contributes to strengthening national security and defense. Based on the analysis of factors affecting the success of seaports as well as the development trend of seaports in Asia and the Pacific. and Vietnam, along with the basis of the Vietnam Port System Development Plan to 2020, orientation to 2030, the orientation of maritime and seaport development in Vietnam is focused on: Shipbuilding Industry In 2020, to develop our country's shipbuilding industry to an advanced level in the region and build ships of up to 300,000 DWT, passenger ships, petroleum service ships, rescue and rescue ships, and security.

## **2. Material used for shipbuilding industry**

### **2.1. Iron-based alloys**

Shipbuilding steel is carbon steel but this type of steel usually has a higher thickness and better quality than conventional carbon steel plates. This steel contains from

0.15% to 0.23% carbon and high manganese content. Two components including sulfur (S) and phosphorus (P) in shipbuilding steel must be at the lowest level, below 0.05%. Shipbuilding steel is usually standard steel plates: A242, A440, A441 and A588. This is a very high strength marine steel. All steel of this type has been designed to be optimal for the maritime industry, shipbuilding with length, along with: frames, floors, walls ... High durability selected for shipbuilding with a capacity of 51,000 psi (355 MPa), and tensile strength of 71,000 - 90,000 psi (490-620 MPa). As previously known, cast iron is a Fe-C alloy with carbon content exceeding 2% (2.14%, right to point E of the Fe-C state diagram). Carbon is an important element in cast iron. From the Fe-C state diagram, it is clear that the high carbon content, the melting temperature of the cast iron is considerably lower than that of the steel, so the fact that cast iron is easier to perform than steel. Do not use cast iron > 5% C. The other two common elements in cast iron with a large amount (0.5 to over 2%) are Mn and Si. These are two factors that govern the formation of graphite, the mechanical properties of cast iron. In the limited cast irons of these two elements change in a relatively wide range.

Phosphorus and sulfur are two elements with a low content of 0.05 to 0.5%, in which sulfur is the least harmful element to cast iron. In addition, iron can contain other

elements such as alloy elements (Cr, Ni, Mo ...), denatured elements (Mg, Ce ...).



**Fig.2:** Standard shipbuilding steel plates A242, A440, A441, and A588

Carbon steel is a steel in the unorganized organization Ledeburite, in addition to carbon and iron there are some impurities Mn, Si, P, S. Manganese and Silicon go into the composition of steel from the following sources: Into the iron ore, so go into the composition of the cast iron and then into the steel. When steel is used, ferrosilicon and ferroanganate are used to remove oxygen, so some of these elements also enter the steel. Mn and Si are two beneficial impurities, which enhance the mechanical properties of steel so that it does not matter to remove them during the process. Under normal conditions of metallurgy, they are in steel with the following amount: Mn <0.8%; Si <0.50%. Phosphorus and sulfur also go into the composition of pig iron due to their existence in iron ore and fuel. For steel, both elements are harmful impurities, so during the process must remove them. P and S depletion are costly, so just reduce their constituents in steel so that the harmful effect is negligible. Generally speaking, most of the steel, the amount of each element is less than 0.05%. So any carbon steel contains the following elements in the following limits: C <2%, Mn <0.8%, Si <0.5%, P, S <0.05%. However, carbon steel also has many disadvantages, including the low permeability, so that the heat treatment efficiency is not high, the temperature resistance is high, while the alloy steel outside the following High thermal properties also have some special properties such as corrosion resistance, high temperature resistance, magnetic properties and special electricity. Alloy steels have properties that are superior to carbon steels, in other words steel alloying is in the following aspects: In general, alloy steel generally has a higher durability (limited durability, flow limitation) than carbon steel, which is especially noticeable after tempering me and ram. On special physical and chemical properties, it is found that carbon steel is rusted in air, corroded in acidic, basic and saline environments, with no special physical characteristics such as magnetic expansion special heat. This requires the use of a variety of alloy steel with a strong chemical composition. It can be seen that alloy elements work very well. Alloy

steels are an inexpensive metal material for heavy machinery, tools, thermoelectricity, and chemical industry. It is usually made of the most important detail in heavy working condition. Each alloy element used more or less (not even used) in a particular steel group depends on its effect on the properties of the steel. It is common to see that each steel uses only one alloy element at a certain level. For example, for structural steels that require higher durability, they often use elements that enhance the permeability of chromium, manganese, nickel, and silicon, with a content of 1 to 2 percent. High speed machining tools have to use high strengths such as tungsten, cobalt, molybdenum with high content of 5-20%. Steel with special chemical and physical properties also has special characteristics such as stainless steel containing no less than 12.5% Cr, abrasion resistant steel with 13% Mn, steel technical steel with 2-4% Si etc ... Ship plates are a hot rolled steel sheet produced to produce hull structures required by construction codes. China social classification standard standards on the general strength of steel structure is divided into: A, B, D, E four levels of quality. All welds are performed by qualified welders, using an approved welding method and a low metal hydrogen filled. Welding so there is no defect, piercing completely and without undercut and Korean tumor. Welded metal is reinforced with less than 1.6 mm and then removed and ground with a smooth grinding or erasing method with roll surface and will exhibit a good finish. Hot rolled steel plate is produced in accordance with the relevant Classification Association. Our shipbuilding steel products include steel shipbuilding plates, fabricated steel parts and floor plates for shipbuilding steel supplied under ASTM / ASME (ASTM A131 / ASME SA 131) as characteristics. Standard engineering for Steel Structure for ships. Shipbuilding steel has higher durability according to standards. High-strength steel offers significant cost advantages by reducing the weight of the structure compared to the steel used. The panels are suitable for use in the construction of container ships and large freight transport as well as commercial shipping routes such as



luxury cruise ships and ferries. Supply options include heavy plates, surface treated sheets and pre-fabricated parts. In most cases, steel can also be supplied in hot rolled coils or cut into lengths (plate). These high-yield materials

are often used in the construction of hulls and superstructures for large transport vessels. Classes are reserved for the use of shipbuilding as outlined in the standard.

**Table 1:** Mechanical properties of AH36 steel

AH36	Re	Rm	% Length	
			A50mm	A200mm
	MPa	MPa	%	%
355	490/620	22	19	

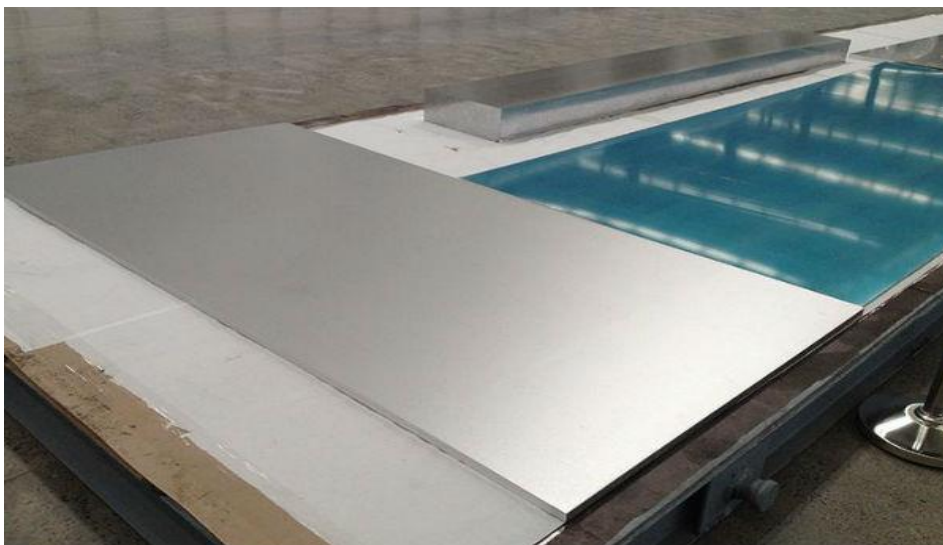
**Table 2:** Chemical properties of AH36 steel

AH36	% mass
C	0,18
Si	0,10 / 0,50
Mn	0,90 / 1,60
P	0,035
S	0,035
Cr	0,20
Mo	0,08
Ni	0,40
Cu	0,35
Cb	0,02 / 0,05
V	0,05 / 0,10

## 2.2. Aluminum-based alloys

Shipbuilding aluminum is one of the most well-known materials with outstanding advantages: high durability, good forming ability, optimal corrosion resistance. On the market today there are many types of aluminum sheets with aluminum grades, origin and various sizes. In particular, shipbuilding aluminum always holds the absolute advantage in shipbuilding, civil and military industries. Unlike iron with a history of thousands of years, aluminum has a history of over a century, but has a tremendous amount of money because of its large reserves (nearly twice as much iron), light (nearly triple durable metal (highly durable aluminum alloy that has the same strengths as steel structural steel) and high corrosion resistance (higher iron content). Unlike iron, aluminum is a metal with no transformational transformation, it has only one type of crystal lattice structure, centered on the network parameter  $a = 4.04$  atomic diameter of 2.86. Small mass ( $\gamma = 2.7 \text{ g / cm}^3$ ) should be used extensively in aircraft

manufacture. High corrosion resistance: Pure aluminum with high purity is highly corrosive and chemically very high, due to its strong affinity for oxygen, so its surface always has a thin and dense oxide layer of  $\text{Al}_2\text{O}_3$ . tight, highly protective. The lower the cleanliness of aluminum, the less corrosion resistance it has. High conductivity and electrical conductivity: Aluminum conductivity is high, equal to 60% of copper, plus a lightweight, with the same weight, aluminum conductors are better than copper. In electrical engineering has used quite a lot of electric wire from aluminum. The aluminum conductivity is 0.3426 inches / cm.s.OC higher than iron and steel. Low flow temperatures (6600C) can make the process easier, but aluminum alloys do not work at high temperatures. Hiding the heat of crystallization and melting of large aluminum, so the aluminum castings slowly cooled in the liquid state facilitates the process of refining fineness. However, its castability is not high due to high shrinkage (up to 6%).



**Fig. 3:** Aluminum-based alloys for shipbuilding

Aluminum alloy 5083 is more durable than aluminum 5052 alloy, has good electrical conductivity, easy machining thanks to the excellent plasticity of aluminum, this type of aluminum is very suitable for cutting welding and can harden with cold rolled. In addition, the AA5083 aluminum alloy plate is an aluminum label that has excellent corrosion resistance in marine environments, capable of withstanding good tensile and bending force. Moreover, aluminum alloy A5083 also has good welding properties, so aluminum alloy A5083 is mainly used for shipbuilding. Thanks to the higher durability, aluminum is used in the manufacture of alloys. According to technology, aluminum alloys are divided into castings, deformed and sintered. Aluminum alloys and deformed aluminum alloys are produced by melting. The basis for distinguishing the boundary between the two in a given alloy system is the aluminum-alloy state diagram. Deformed aluminum alloys are alloyed aluminum alloys that are within the limits of the solid solution, ie to the left of the C 'point. It is possible that at normal temperature the alloy has not been fully held solid solution (with the second phase added) but when heated to the appropriate temperature (eg higher than the CD) will be held so, very easily deformed (rolled, forged, stamped) as desired. Alloyed aluminum alloys do not contain the same crystals, which are easily deformed not only at one-phase temperature but also at normal temperatures. Within the range of the aluminum alloy deformation is divided into two groups: thermofiltrate and thermofiltrate. Alloy components on the left side of the D point when heated or cooled have no phase shift and cannot be chemically stable. The alloys at the right of the point D (from D to C '), at normal temperatures outside the solid solution also have a second phase, when heated, this phase is completely dissolved into solid solution when cooled The fast settling of the solid solution is too saturated and becomes unbalanced, releasing dispersed phases for increased durability. Aluminum alloy castings are aluminum alloys with alloying elements so that in their organization they contain essentially identical crystalline castings. In principle, the alloys to the right of the 'C' point in the molding are then co-finned and will be cast aluminum alloys, but in practice they are often used with fairly large components and finally the crystal. It is noted that the alloy aluminum alloy contains a higher amount of alloy elements than aluminum alloy deformation. Sintered aluminum alloys are aluminum alloys made from the original element of supercritical powder and sintered.

### Conclusions

With a long coastline and exclusive economic zone on the East Sea, Vietnam has always been identified as a country with a favorable position to develop shipbuilding industry. Along with the increasing transport demand in recent years, when Vietnam is increasingly integrated, these are opportunities and potentials for the shipbuilding industry to develop. Ships are a large and diversified industrial product. The shipbuilding is also closely related to many different industries, especially the mechanical sector, some key areas such as steel production shipbuilding, fabrication and assembly of hydro-mechanical equipment and machinery. Therefore, the development of these supporting industries will create good opportunities for Vietnam shipbuilding to participate in competition in the international market. At the same time, development of

shipbuilding will lead to a series of mechanical fields to develop. In fact, the shipbuilding industry only stopped at processing and assembling because supplies, machinery, equipment, iron and steel ... must be imported from abroad. In terms of design, only small vessels can be designed for dry cargo, while large vessels, oil tankers, container carriers, liquefied gas carriers and large construction ships all have to hire foreign designers. There are four main disadvantages: small capacity; backward technology level; scattered production forces; small and fragmented investment. Due to the dispersed force, while not using up the capacity and capacity of existing facilities, some units still invested in new similar production lines, causing huge waste.

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