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Novel materials applied to the shipbuilding industry

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Abstract: It can be said that the maritime world, including corporations of maritime nations in the world, has been interested in Vietnam for two reasons. First of all, Vietnam is a market of marine equipment and boats with a population of nearly 100 million. Second, Vietnam is also a manufacturing and shipbuilding country, has a long history and abundant labor force, relatively low labor costs and that is a studious workforce. Although there are still many issues that need to be trained, it is a young and significant labor force so the world is very interested in Vietnam's shipbuilding field.In the strategy of marine economic development, the maritime sector plays an important role, in which seaports are the nucleus of development, the focal point for receiving and transporting import and export goods and circulating to all regions of the country. Shipping now accounts for 90% of the volume of imports and exports and part of the goods to regions, the main artery in the system of transportation and distribution of goods of the economy. The maritime industry and the world are developing and developing both in terms of quality, quality and modernity. Special welds between the various types of materials always have a number of problems that need to be addressed in order to improve the quality of welding and the life of the equipment. This paper presents and classifies the materials used in the maritime industry.

Index Terms: material, marine industry, polymer

I. INTRODUCTION

Firstly, the shipbuilding industry is very important, first of all serving the country. Characterized by low profits, all countries in the world are required to equip the shipbuilding industry to create their maritime power, to protect the country, especially a nation join the sea. Secondly, the shipbuilding industry characteristics require very high investment and low efficiency, so the role of the State here is to make huge investments, so the shipbuilding market must be particularly interested in the State into a defensive power on the sea, creating a strong fleet to serve the transport and travel of the people such as tourism, fishing ... and if surplus, then export. Previously we had planned a little too ambitiously, we wanted to become a shipbuilding nation, the fourth largest shipbuilding country in the world, and that ambition has led to past failures. First of all, don't expect to build a ship, the nature of the shipbuilding industry is an assembly industry. The world has already assigned, for example, mentioning marine equipment, electronics ... there are already brands in the world. Besides, the maritime nations invested in shipbuilding industry, so that this industry pulled up the supporting industry. Vietnam in the past had daydreaming about that, but this was a problem to be considered. 10 years ago, the State invested Vinashin to build large ships of 57-100 thousand tons, for Vinashin to set up an auxiliary factory such as paint factory, electrical equipment factory ..., that formation did not stem from the requirement. of the market. The idea of pulling ancillary industry is very necessary, in order to create a cooperative area, to develop the private sector, not because of the will of the State. Currently, we still impose the State's will for the development of ancillary industry, we call for the development of ancillary industry, but that auxiliary industry must look on the world level, we only assign do some work. There is no concept of a baby ship being easier to build than a big ship. Shipbuilding must start from design, so Vietnam needs to pay attention to two issues, design and management, which are the two points that need to focus the highest. Design and governance are human issues. The lesson from Vinashin is that building 57 thousand tons of ship is delayed by 2 years, while the progress is what the foreign side is extremely interested. Time is money, and time is all human, governed. The painful lesson of Vinashin is that it is possible to spend money to buy one, another, to return a machine, but not to prepare well for people. Therefore, the upcoming work must pay special attention to human resources issues.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 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.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. 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 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

In some industries such as oil and gas, nuclear, shipbuilding, some welding connections between conventional carbon steel and stainless steel are being used extensively to improve corrosion resistance in working conditions production costs are reduced. In fact, in Vietnam, the creation of welding bond between the two materials encountered a number of problems: Firstly, in the process of welding stainless steel and carbon steel is very common occurrence of deformation, hot cracking, microscopic cracking in the puddle and in the heat affected area. The fundamental cause is the change in microstructure during welding or the influence of alloying elements. On the other hand, these factors also lead to changes in the mechanical properties of the base metal and weld metal. Second, the technological parameters of the welding process also greatly affect the quality of the weld. The welding power, voltage, welding speed, cold environment are the basic factors that determine the organization of the welding process. At present, there are many methods used in welding stainless

steel such as GMAW, GTAW, SAW ... However, the choice of which methods to bring the highest efficiency is still very little attention, but mainly based on experience. At present, in some plants, the technology of welding stainless steel with quality carbon steel is just to stop the bonding of joints and meet the criteria of the mechanical properties of the registry. regulations. Further studies on the nature of the welding process or organizational changes, properties and factors affecting the welding process have not yet been considered.Although there have been many studies in the world as well as in several Asian countries, they have also achieved certain successes in improving the quality of welded joints between steel. rust with other materials. However, the research results are not properly considered in Vietnam. Factories have not been able to obtain specific research results for effective application. Moreover, the welding heat treatment equipment in our country has not been specifically studied, especially welding heat treatment equipment for the marine industry, one of the sectors to use the number of raw materials.

II. MATERIAL USED FOR SHIPBUIDDING

As previously known, cast iron is 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 ...).According to the micro-organism, people are divided into cast iron: white cast iron, gray cast iron, cast iron, plastic cast iron. White cast iron is a cast iron in which all carbon is in the form of a bond in Fe3C Xementite. Thus, the microscopic organization of white pig iron is perfectly suited to the Fe-C state diagram which always contains a mixture of Ledeburite crystals. Gray cast iron, bridges, and plastics are cast iron in which most or all carbon is in free form - graphite with different shapes: plates, bridges, clusters. In the absence of Ledeburit, therefore, the microorganism does not conform to the Fe-C state diagram.The microstructure of graphite cast iron depends on the distribution of carbon in the graphite and cementitious phase. They divide their organization into two parts: the nonmetal part - graphite and the metal base of ferrite and cementite. When all carbon is free, the organization's metal base consists only of ferrite. When carbon is in the link state, the base metal of the organization may be ferrite, pectite, peclitite or peclitite. It is because of the organizational nature of such casts that they have different uses and uses. To achieve a microscopic organization, each type of iron has different elemental constituents.

In general, cast iron is a material with low tensile strength, high brilliance. Xementite is a hard and brittle phase, its presence in large amounts and concentrated in cast iron makes it easy to crack under the effect of pulling load, white cast iron has low tensile strength and high brilliance.

Fig.2. Shipbuilding based on the steel

Geographically, Vietnam has a lot of favorable conditions to develop the shipbuilding industry when we have a long coastline and the exclusive economic zone in the South China Sea more than 1 million km2. Vietnam is one of the 10 countries with the highest length of the coast in three directions, East, South and Southwest. With these characteristics, we have always been identified as the country with the most favorable position in the region in developing shipbuilding. Not only the natural conditions but also Vietnam's policies support the development industry. By 2020. Vietnam has identified the marine economy as a driving force to entice and promote other economic regions to develop. From there, create a fundamental and comprehensive change of the marine economic structure towards industrialization and modernization. An important step to implement the marine strategy until 2020 is to develop the shipbuilding and repairing industry. Not only that, the demand for shipping by sea is also increasing, so the shipbuilding industry will have many opportunities in the market, although the shipbuilding market in the country as well as the world is experiencing In the most depressing period, the number of newly built and repaired ones has decreased significantly due to the impact of the world economy, but there are still many positive opportunities for Vietnam's shipbuilding market. With the available potentials and especially the policy from the government through the strategy of sustainable development of Vietnam's marine economy to 2030, the vision to 2045 is opening Vietnam many opportunities for market development. domestic as well as expanding cooperation with shipbuilding powers in the world.

In gray cast iron, cast iron, graphite ganglion holds graphite as holes are available in cast iron, where stress is concentrated, making cast iron unstable. The concentration of stress depends on the graphite shape, the largest in gray cast iron with the smallest graphite graphite in graphite with round-shaped graphite. Thus, ductile cast iron has the highest durability coupled with the best plasticity in cast iron. In addition, the presence of graphite in cast iron has some good mechanical effects such as increased frictional wear resistance (because graphite itself is lubricated, in addition there is a "hole" of graphite that holds lubricating oil, such as when used as a sliding disk), to switch off vibration and resonance oscillations.In terms of technology, cast iron and good machining characteristics: cast irons are commonly used in the semiconductor composition, so the flow temperature is low, so the high water content is one of the important factors.molding, graphite in gray cast iron, plastic and brittle chip to break when cutting (turning, milling, planing ....). In general, cast iron is not as high synthesized as steel, but good castability, easy machining, simpler production (due to low flow temperature, molten iron and cast iron easier than steel) and cheap. Graphite castings are used extensively in mechanical manufacturing.People use cast iron to make a lot of machine parts. For example, in the car cast iron parts can account for up to 40% of the metal mass, in appliances and static machines, up to 50 - 80%. There are many types of products used in large quantities, made of cast iron such as large water pipes. In general, cast iron is used to make static load bearing parts that are less resistant to impact such as machine supports, shells, lids, and less moving parts.There are now good casts with high mechanical strength, which can be used to replace steel in some cases, such as cast iron for crankshaft.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, ferosilicon 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. This advantage is usually expressed in all steel alloys, the better the strength of this alloy is clear. Along with the increase in the level of alloying, the technology of steel will deteriorate.For high temperature resistance, it is found that carbon steel is relatively stable after steeling, but can not be kept working at temperatures higher than 200^0C because the magnesite is broken down and the aggregate is agglomerated. Alloy elements interfere with the diffusion of carbon so that the magnesium is dissociated and the carbides are agglomerated at higher temperatures, so that the alloy steel retains high mechanical strength of the mine state at temperatures above 200^0C. . To achieve this, steel needs to be alloyed by a relatively high number of elements.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, 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 ...Commonly used elements are chromium, manganese, nickel, silicon, tungsten, molybdenum, vanadium, cobalt, titanium, and boron, in which manganese and silicon are the two most abundant elements.Structural steel is mainly used for making machine parts (axles, gears, power transmission rods, springs, bearings etc.). Compared to conventional steels, they are used in smaller volumes, but are of a higher quality and have more variety and are often subjected to heat treatment to maximize their performance.As used in machine parts, structural steel has to meet the following two basic requirements: good machinability in the machining state (pressure processing and machining) and good synthesis Workability (mainly high impact strength at the core and high surface hardness to prevent abrasion).About the carbon content: To ensure that structural steel is usually low and medium carbon steel, usually within the range of 0.1-0.6% highest not more than 0.65%.Regarding alloying elements: Alloy elements for structural steel mainly enhance the permeability and improve the mechanical properties (ferrous bond strength), but if too much will undermine the technology and raise the price. Thus the alloy elements in structural steel used less often only 1-3%, individual also only 6-7%.

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 (γ = 2.7 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 Al2O3. 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.0C 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%).Relatively low strength: Aluminum with high purity after rolling and incubation has σ_b = 60N / mm2; $\sigma_{0.2}$ = 20N / mm2, a hardness of 25HB is only 1/4 to 1/6 of the iron, so almost no pure aluminum makes the machine parts. In machines, the use of aluminum alloys is significantly higher.High flexibility: Pure aluminum is very flexible, δ = 85%, δ = 40% so it is easy to deform in cold state and in hot state, low cutting machinability of aluminum.

Copper alloys are relatively high in mechanical properties, good in technology and less friction while maintaining the advantages of copper as their thermal conductivity, conductivity and good chemical stability.The alloy elements of copper commonly used are Zn, Sn, Al, Be, Mn, Ni ... they significantly improve the durability but actually do not do bad (in some cases also improve) plasticity in the range of concentration Determination. It can be said that plasticity is a prominent advantage of copper alloy.In terms of technology, the copper alloys are divided: deformed alloys and cast alloys. Thermal treatment is divided into two types: durable and non-chemically stable.In practice the prevailing classification of copper alloys by chemical composition. According to the chemical composition, the copper alloys are divided into two main groups: the fly (Zn alloy) and the copper alloy (Zn alloys).Tin tongue: As stated, the slippery tin is a soft material that is solid and solid. The advantage of tin can is that it undergoes great pressure and has a higher ring speed than the gray cast iron, which often makes important slides. Can be used with the numbers BSn10V1 and BSn8Pb12.In practice it is often used with complex tins to make the lining required to resist abrasion and less friction. For the silver lining of the neck and the neck of the crankshaft, the BSn5Zn5Pb5 (in casting state) and BSn4Zn4Pb2.5 (in the deformed state) are used. Solid particles, in the form of individual particles, reduce friction.Sticky: The lead character is characterized by low friction and high thermal conductivity, in addition to good load resistance and

damping and fatigue resistance. Therefore, the lead is used as the important slider, high load and high speed as the slip of the aircraft engine, diesel, tuocbin ....BPb30 is currently most commonly used with about 30% lead. Because Pb is insoluble in Cu in solid state and dissolved in liquid state, therefore, when casting, it has the same geometry. Therefore, in order to avoid the phenomenon of crystallization, it is necessary to crystallize molten metal with fast speed. Simultaneously classify and place small Pb particles evenly distributed on the copper substrate. When working the Pb particles are worn out quickly to form an oil reservoir, while the Cu supports the shaft.The BPb30's mechanical properties are relatively low (σb = 60N / mm2, δ = 4%, 25HB), and mechanical properties are often cast onto steel or tubing, Further alloying with Sn, Ni, Mn will form a solid solution with Cu to improve the strength of the alloy and can be used immediately without the steel trough.When using a lead spatula, attention must be paid to the high stiffness of the shaft to prevent wear of the shaft and the lubrication of the oil must be low acidity.In the present stage, integration and globalization have become a trend of the world, which is also the time when science really becomes direct production force with great influence on all fields of life. In fact, knowledge economy plays a more outstanding role in the development of production force. According to statistical reports, Vietnam currently has about 120 shipbuilding and repairing factories with a tonnage of over 1,000 tons, with 170 lifting and lowering works. The total design capacity of the plants 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 investing heavily. However, it is only in the process of receiving transfer from major shipbuilding centers in Asia. The overall picture of the shipbuilding industry is as follows: Vinashin, established in 2006, is now the Shipbuilding Industry Corporation - SBIC, which plays a key role. Sadly, however, the collapse of Vinashin has caused the shipbuilding industry and many of its workers or other shipyards to cancel applications and fall into misery. In addition, Vietnam's shipbuilding industry has shipbuilding facilities owned by Vietnam National Shipping Lines (Vinaline), Vietnam National Oil and Gas Group and a number of state-owned corporations and corporations. Along with that are the shipbuilding facilities managed by the Ministry of Defense, local businesses or FDI enterprises.

Fig. 3. PPC composite for shipbuilding

Currently, many shipbuilding enterprises in our country have the desire to apply this technology, but still have problems at the registration stage. Recently, the Vietnam Register has certified for a pilot production of a passenger ship model, five models of recreational sports boats and a canoe, ship and boat dock. But this is just a trial, businesses are still worried, do not know how to soon bring new products and technology applications into the market. The fact that James Boat Technology Joint Stock Company has used PPC material to build two patrol boats as a pilot production project, the cost paid by the enterprise itself is very welcome. The research results of the project have been accepted by the Scientific Council of the specialized branch and its products. However, to be able to use PPC as shipbuilding material in the form of commercialized products for civilian and national defense, instead of building small boats with traditional steel and wood materials, we need to have Specific standards are issued by specialized agencies. With the advantages of shipbuilding industry, PPC material is suitable for replacing old materials when building small boats. Therefore, it should soon solve problems, quickly commercialize products.Composite is a mixture of at least two phases or two components of material. This combination aims to limit the disadvantages of one material by the advantages of the other,

creating products with different mechanical properties than the original materials.

(1). Both components must have a reasonable ratio (each component must account for at least 5%).

(2). Only when the component phases have different mechanical properties and the mechanical properties of the composite material differ significantly from the mechanical properties of the component material. For example, plastics, although there are a number of substances such as lubricants, anti-ultraviolet rays, commercial substances such as cost reduction and ease of processing, etc., do not meet the secondary standard. The two therefore are not considered composite materials.

(3). In composite materials, the component materials are not completely dissolved. Therefore an alloy with a two-phase microstructure created during the solidification of homogeneous molten metal is not considered a composite material. However, if ceramic elements, for some reason, are mixed with metal to create a material that includes metal containing ceramic particles, the material is composite.

Chemically, composite has two separate (or more) phases, separated by a separate interface. The component that persists in larger volumes in the composite is called the substrate. From a conventional perspective, the properties of the substrate are improved by coordination with other components to create composite materials. Composite may be based on ceramic, metal or polymer. The properties of the three types of background vary significantly. Polymers have low tensile strength and modulus; hard and brittle ceramic; The metal has moderate strength and modulus of elasticity, and has good ductility. The second component is called reinforced, which increases the properties of the substrate. The geometric characteristics of reinforcement are one of the main parameters for determining the effectiveness of reinforced materials; In other words, the mechanical properties of composite materials are a function of the shape and size of the fiber material. The core material is usually in the form of fibers or particles.PPC has many outstanding features such as being able to withstand hot weather without deformation, durable in a wide temperature range of - 30° -260°C, good insulation and sound insulation, no rust, no cause Environmental pollution. In particular, PPC hull is not subject to aquatic organisms, withstand strong impact (even preventing bullet penetration). When moving, the hull of elasticity helps to reduce shock, less friction than wooden and steel hulls so it reaches high speed, easy to rotate, but saves fuel. When processing PPC using special heat welding technology, does not generate toxic substances for humans and the environment; 100% recyclable materials and scrap.

III. CONCLUSION

Steel fishing vessels after being completed and put into use, from the first 2 to 3 months, fishermen still can not assess the quality of steel with the naked eye but it takes about 1-2 years later because steel vessels after 2 years to carry out pull up momentum for mid-term maintenance, after 5 years of periodic maintenance. Every time of maintenance, only clean the hull and repaint the ship, check the silver and the engine. At that time, the naked eye will see, if bad steel will rust, local corrosion, steel pitted, surface less places more places, strong corrosion. If the steel is good, it corrodes evenly. After cleaning, the surface of good steel is clear, while bad steel quickly turns to a dull color like lead. On the journey to learn about steel quality, many engineers and ship owners shared about the risks that fishermen face when building steel ships. But when the ship broke down, pulled up to repair and replace some surfaces on the hull, then susceptible to sticky steel. Normally, contractors will commit to using good steel, but then bring in low quality imported steel to make more profit. These steel plates put into shipbuilding after a short time will be very rotten and punctured.

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