EXPERIMENTAL AND PREDICTION OF CTOD METHOD USED MONEL AND INCONEL WELDING

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The dissimilar metal weld is demanding as well as the similar weld, however, dissimilar weld is more complex than similar weld due to the necessity of being applied in zones where a requirement is to improve some properties.**Inconel** and **monel**has an excellent combination of mechanical properties and corrosion resistance making it suitable for applications with possibility of corrosion promoted by sea water and transportation of liquid nitrogen, helium and some biomedical applications. This paper discussed about dissimilar weld of **Inconel** and **Monel**using TIG welding in Various Parameters and to evaluate the Mechanical(hardness, Toughness) Properties.

INTRODUCTION:

With the development of the ocean engineering, the high-strength steel and ultra high strength steel are widely applied in the Deep water Semi Submersible Drilling Platform. As the complicated welding joints, high-strength and big thickness, the welding procedure of the marine structure becomes the key to the construction of the platform. The specification and classification societies around the world are beginning to take the CTOD tests as a means to assess the toughness of the welded joints and the high-strength and heavy steel plates. However, there is much difference on the allowance value of CTOD with different societies, especially for the new high-strength and heavy steel plates.As the steel plates applied in the ocean engineering structure becomes more and more thicker, the acceptable CTOD value of different Standards are applied to prevent the structural safety and stability.

It is good practice in any measurement to evaluate and report the uncertainty associated with the test results. A statement of uncertainty may be required by a customer who wishes to know the limits within which the reported result may be assumed to lie, or the test laboratory itself may wish to develop a better understanding of which particular aspects of the test procedure have the greatest effect on results so that this may be monitored more closely. Fracture toughness is usually used as a generic term for measures of material resistance to extension of a crack. It is restricted to results of fracture mechanics tests in this work, which are directly applicable to fracture control and to fracturetest in describing the material property for a crack to resist fracture. The experimental measurement and standardization offracture toughness play an imperative role in application of fracture mechanics methods to structural integrity assessment,damage tolerance design, fitness-for-service evaluation, and residual strength analysis for different engineering component sand structures. The fracture toughness values may also serve as a basis in material characterization, performance evaluation,and quality assurance for typical engineering structures, including nuclear pressure vessels and piping, petrochemical vessels and tanks, oil and gas pipelines, and automotive, ship and aircraft structures. Therefore, fracture toughness testing and evaluation has been a very important subject in development of fracture mechanics method and its engineering applications.

SELECTION OF MATERIAL

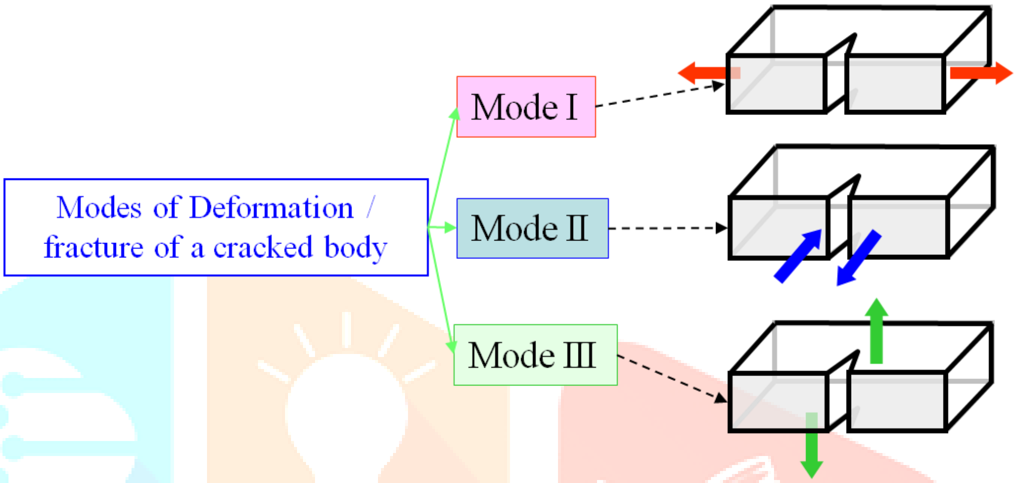
Monel

Monel is a group of nickel alloys, primarily composed of nickel (up to 67%) and copper, with small amounts of iron, manganese, carbon, and silicon. Stronger than pure nickel, Monel alloys are resistant to corrosion by many agents, including rapidly flowing seawater. They can be fabricated readily by hot- and cold-working, machining, and welding.

Monel was created by Robert Crooks Stanley, who worked for the International Nickel Company (INCO) in 1901. Monel alloy is a binary alloy of the same proportions of nickel and copper as is found naturally in the nickel ore from the Sudbury (Ontario) mines and is therefore considered a puritan alloy. Monel was named after company president Ambrose Monell, and patented in 1906. One L was dropped, because family names were not allowed as trademarks at that time. The name is now a trademark of Special Metals Corporation. It is a very expensive alloy, with cost ranging from 5 to 10 times the cost of copper and nickel; hence its use is limited to those applications where it cannot be replaced withcheaper alternatives.

EXPERIMENTAL SETUP:

Our experiment consist of 2 different materials like Aluminium, Nickel,etc.. and electrode



TEST TAKEN:

HARDNESS TEST

A simple and economical way to characterize the mechanical properties and microstructure is by performing hardness measurements. By performing hardness measurements the highest and lowest levels of hardness can be determined. In dissimilar metal welds the hardness level of parent metals and weld metal are determined. The most interesting part is where the transition from parent metal to weld metal takes place and in the root bead of the weld.

A cross-section from each sample is taken transverse the weld by mechanical cutting. It is important that the preparations of the samples do not affect the surface metallurgical by hot or cold work. After the samples are cut they are grinded and polished in order to make as good preparation as possible. The numbers of indentations need to be enough to assure that hardened and softened zones are tested, i.e. that the indentations do not affect each other.

This gives the metals ability to show resistance to indentation which show it's resistance to wear and abrasion. Hardness testing of welds and their Heat Affected Zones (HAZs) usually requires testing on a microscopic scale using a diamond indenter. The Vickers Hardness test is the predominant test

TOUGHNESS TEST :(FRACTURE TOUGHNESS)

It is well understood that ductile and brittle are relative, and thus interchange between these two modes of fracture is achievable with ease. The term ductile to-Brittle transition(DBT) is used in relation to the temperature dependence of the measured impact energy absorption. For a material, as the temperature is lowered, the impact energy drops suddenly over a relatively narrow temperature range, below which the energy has a considerably lower value as a representative of brittle fracture.The principal measurement from the impact test is the energy absorbed in fracturing the specimen. Energy expended during fracture is sometimes known as notch toughness. The energy expended will be high for complete ductile fracture, while it is less for brittle fracture. However, it is important to note thatmeasurement of energy expended is only a relative energy, and cannot be used directly as design consideration. Another common result from the Charpy test is by examining the fracture surface. It is useful in determining whether the fracture is fibrous (shear fracture), granular (cleavage fracture), or a mixture of both.

CONCLUSION

As the steel plates applied in the ocean engineering structure becomes more and more thicker, the acceptable CTOD value of different Standards are applied to prevent the structural safety and stability. Such as the minimum acceptable value for required standard. This paper takes the single edge fatigue precrack of CTOD specimen as a flaw under the guidance of ASTM Standard, plots the FADs of the welding seamcenter. The failure boundary value which are applied in the acceptable value of CTOD.In the meanwhile, the present CTOD test ensures the straightness of the front crack with the partial compression method, which would cause the results of test much more conservative. According to the critical CTOD value calculated above, it suggests that the CTOD acceptable value of heavy plates could be modified lower appropriately based on value specified by Standards.

REFERENCES

1. O.P.Khanna,"Text book material science & metallurgy" Dhanpatrai publications (1999)
2. C.P.Sharma, " Engineering material properties and application of metals and alloys" PHI Learning Pvt Ltd, delhi 2013
3. R.B.Choudry, " Material science and metallurgy" Khanna publications 2011
4. N.K.Srinivasan, " Welding technology" Khanna publications 2012
5. P.R.RAMANATHAN "Piping and welding technology", 2014.
6. PD6493:1991.Guidance on some methods for the derivation of acceptance levels for defects in fusion welded joints.
7. Parmar.R.S. "Welding Engineering and Technology", Khanna publishers, Delhi. (1997)