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RESEARCH ARTICLE

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EFFECT OF SALT SPRAY TESTING ON EN19 & EN8D ALLOY STEEL

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ABSTRACT

The present research work is reporting the salt spray testing of EN19 & EN8D material. A round bar specimens are prepared of these materials and then it is imported in salt spray testing experimentation. For experimentation two kinds of specimens are prepared, one is without zinc coating & other is being coated with zinc i.e galvanization .The testing of these material is done & rusting is being analyzed during the experimentation. The study of salt spray testing of these materials are resulted out from the experimental data. The experiment result outcome is beneficial for industrial applications

Keywords-Salt Spray Test, EN material, Rusting, Plating.

1.INTRODUCTION

EN for steel stands for “Emergency Number” or “European norms” in British standards. This standard was created during the start of second world war in the year 1939. Before this, steel was designated by their carbon content & some time is called by the name of mill or steel manufacturer. EN-19 & EN8D are grades of steel. These are formally known as alloy steel. These materials have their great importance for industrial purposes.EN19 is an oilhardenable chromium molybdenum steel used for gears & high strength shafts etc with better resistance to shock loads. Available in black round or square bar & bright round, hexagonal bar.EN8D is medium carbon & medium tensile steel.

Applications of EN19 are axles; drive shafts; crankshafts; connecting rods; high tensile bolts; studs; propeller shaft joints; rifle barrels; induction hardened pins; high tensile bolts &studs; connecting rods; gears etc .

Applications of EN8D are in the fabrication of crank shafts; axlebeams, connecting rods., bolts and nuts ,machine components, etc; for engineering units; forging industries and machine component manufactures.

The purpose for investigate on these materials is because of fact that EN19 has following characteristics i.eA 6% allowance should always be made for removal of surface defects during machining; Machinability good.; Easily Weldable & EN8D has following characteristics i.e Precise chemical composition; Narrow band of hardness; Dimensional tolerance; Defect-free surface.

1.1 Chemical composition of EN19& EN8D are demonstrated in table 1 & table 2 given below

Table 1

Sr. No.-	1	2	3	4	5	6	7
Chemical Name	Carbon	Silicon	Manganese	Chromium	Molybdenum	Sulphur	Phosphorus
Composition %age	0.36-0.44	0.10-0.35	0.70-1	0.90-1.20	0.25-0.35	0.35max	0.040max

Table 2

Sr. NO.-	1	2	3	4	5
Chemical Name-	Carbon	Manganese	Silicon	Sulphur	Phosphorous
Composition %ge	.40-.45	.70-.90	.05-.35	.060max	.060max

2.LITERATURE REVIEW

2.1 L.A. Dobrzanski et. al(2007)[1] worked on Corrosion resistance of sintered duplex stainless steels in the salt fog spray test.In this research work, they have studied that the corrosion properties have been studied through salt fog spray test which is applied by the automotive industry end-users.It is resulted out that sintered duplex stainless steels shows good corrosion properties in chloride environment.

2.2 M.P. Papadopoulos et. al(2007)[2] worked on Effect of salt spray corrosion exposure on the mechanical performance of different technical class reinforcing steel bars.For experimentation artificial corrosion is done on the tensile specimens of different reinforcing steel bars in laboratory salt spray tests & then the pre-corroded specimens were tensile tested to study the degradation of the mechanical properties of the material with accumulating corrosion damage.

2.3 M.P. Papadopoulos et. al(2011)[3] worked on Corrosion of exposed rebars, associated mechanical degradation and correlation with accelerated corrosion tests. In their research work,they have studied about corrosion in a large number of steel reinforced concrete buildings in Greece in which spalling of the cement has left the steel reinforcement (rebars) exposed to the atmosphere. A large number of samples (sections of exposed rebars) were collected from buildings up to 96 years old, and weight loss measurements, tensile testing and fractographic analysis were carried out.Salt spray testing is carried out on new similar grade rebars in order to establish a correlation with the naturally corroded exposed rebars. It was resulted out that exposed rebars suffer from uniform corrosion followed by degradation of mechanical properties.

2.4 Shaogang Wang et. al(2011)[4] worked on Characterization of microstructure, mechanical properties and corrosion resistance of dissimilar welded joint between 2205 duplex stainless steel and 16MnR.In their research work, The joint of dissimilar metals is done between 2205 duplex stainless steel and 16MnR low alloy high strength steel are welded by tungsten inert gas arc welding (GTAW) and shielded metal arc welding (SMAW) respectively. It is resulted out that mechanical properties of joints welded by the two kinds of welding technology are satisfied & the corrosion resistance of the weldment produced by GTAW is superior to that by SMAW in chloride solution using salt spray test in laboratory.

2.5 A K Lakshminarayananet. al(2013) worked on Analysis of Corrosion Prevention Methods in Railway Coaches and Bogies. In their work ,they studied about the effect autogenously arc welding processes on tensile and impact properties of ferritic stainless steel conformed to AISI 409M grade. They have used Rolled plates of 4 mm thickness used as the base material for preparing single pass butt welded joints. Evaluation of Tensile and impact properties, micro hardness, microstructure, and fracture surface morphology of continuous current gas tungsten arc welding (CCGTAW), pulsed current gas tungsten arc welding (PCGTAW), and plasma arc welding (PAW) joints are done & results are compared. It is resulted out that the PAW joints of ferritic stainless steel show high tensile and impact properties when compared with CCGTAW and PCGTAW joints which is mainly due to lower heat input, finer fusion zone grain diameter, and higher fusion zone hardness.

2.6 Thiago J. Mesquita et.al (2014)[5] worked on Corrosion and metallurgical investigation of two supermartensitic stainless steels for oil and gas environments. In their work, the corrosion properties of two supermartensitic stainless steels were studied in chloride and H_2S environments. The two SS grades 1.4542 and 1.4418 heat treatment and their microstructure studied. In H_2S media, the 1.4418 presented a higher stability and passivation compared to 1.4542. The Electron backscattering and X-ray diffraction were used to characterize the amount of' retained austenite in the 1.4418 and then its influence on pitting and SSC resistance investigated.

Literature reveals that salt spray test has various impacts as depends upon the materials specifications . These approaches differ from each other as experiments are performed with different parameters with respect to the materials specifications.

3.ADOPTED METHODOLOGY

3.1.SALT SPRAY TEST

The salt spray test is a standardized laboratory test method which is used to check corrosion resistance of coated samples. Coating prevent metal from being corroded thus coatings provide corrosion resistance to metallic parts made of steel, brass etc. As we know that high corrosion resistance can be provided to metallic parts by coating so it is necessary to check the resistance offered by the coated material to corrosion by other means so to predict the life of the part in use. Salt spray test is an accelerated laboratory corrosion test which produces a corrosive attack to the coated samples in order to predict or to check its suitability in use as a protective film or finish. The appearance of corrosion products (oxides) is evaluated after a period of time. Duration of the test depends on the corrosion resistance of the coating; the more corrosion resistant the coating is, then the longer the period in testing without showing signs of corrosion.

Salt spray testing is very popular because it is cheap, quick, well standardized and reasonably repeatable. Salt spray test is widely used in the industrial sector for the evaluation of corrosion resistance of finished surfaces or parts so to predict the life of the material.

Salt spray test

a) Apparatus – The apparatus which is used for salt spray testing shall be of such design as to conform to ASTM B117-03, "Standard Practice for Operating Salt Spray (Fog) Testing Apparatus."

b) Test performance – Salt spray testing shall be conducted as specified in ASTM B117-03, "Standard Practice for Operating Salt Spray (Fog) Testing Apparatus," for a test period of 120 continuous hours.

Salt spray tasting-Salt fog testing-corrosion testing:-

1.It is a standardized Accelerated Corrosion Test.

2.It is also known as neutral salt spray,salt fog test.

3.This is used by industrial sector, construction marine, automotive, military, air craft & aerospace.

Corrosion testing or salt spray testing is an environmental simulation that helps us to estimate component service life to compare candidate or selected material for use with different parts iin our environment & help us to find suitable materials for our applications.

The salt spray test is a standardized accelerated corrosion test which is used to evaluate the relative corrosion resistance materials subjected to a salt spray or fog test at an elevated temperature. Specimens which are to be tested placed in an enclosed salt spray testing apparatus or chamber & exposed to a continuous indirect fog or spray of a salt water solution. This climate is continuously maintained throughout the duration of the test. Salt spray testing is popular because of helps us to select proper suitable corrosive resistance material.

Coating is so done to provide corrosion resistance property for metallic parts. Slat fog testing is an excellent way to test the permeability of materials coatings & seals.

4.RESULT:

Round specimen of diameter 16.3mm EN-19 material & of diameter 20.3 mm EN8D material without galvanization resulted after testing as in table 2

Table 2-EN19 & EN8D Temperature maintained is 30˚C

Plating(Golden/Silver)	Starting Date	Observation Time	Time passed(Hr)	White rust observed	Red rust observed	Fog collected ml/24Hrs
NO	24-4-2014	2:30pm	0:00	NO	NO	-------
NO	25-4-2014	2:30pm	24:00	NO	YES	22ml
NO	26-4-2014	2:30pm	48:00	NO	YES	20ml

From table 2 it is resulted out that for EN19 & EN8D material red rust visible after24 hours.

Round specimen of diameter 17.2mm EN-19 material & of diameter 20.8 mm EN8D material with galvanization resulted after testing as in table 3

Plating (Golden /Silver)	Plating Thickness (micron)	Starting Date	Observation Time	Time passed (Hr)	White rust observed	Black rust observed	Red rust observed	Fog collected ml/24Hrs
TRVZN	12	24-4-14	2:30PM	0:00	NO	NO	NO	-----
TRVZN	12	25-4-14	2:30PM	24:00	NO	NO	NO	22
TRVZN	12	26-4-14	2:30PM	48:00	NO	NO	NO	20
TRVZN	12	27-4-14	2:30PM	72:00	NO	NO	NO	20
TRVZN	12	28-4-14	2:30PM	96:00	NO	NO	NO	22
TRVZN	12	29-4-14	2:30PM	120:00	NO	NO	NO	20
TRVZN	12	30-4-14	2:30PM	144:00	NO	NO	NO	21
TRVZN	12	1-5-14	2:30PM	168:00	NO	YES	NO	23
TRVZN	12	2-5-14	2;30PM	192:00	NO	YES	NO	20
TRVZN	12	3-5-14	2:30PM	216:00	NO	YES	NO	23
TRVZN	12	4-5-14	2:30PM	240:00	NO	YES	NO	21
TRVZN	12	5-5-14	2:30PM	264:00	NO	YES	NO	23
TRVZN	12	6-5-14	2:30PM	288:00	NO	YES	NO	20
TRVZN	12	7-5-14	2:30PM	312:00	NO	YES	NO	21
TRVZN	12	8-5-14	2:30PM	336:00	NO	YES	NO	23
TRVZN	12	9-5-14	2:30PM	360:00	NO	YES	NO	21
TRVZN	12	10-5-14	2:30PM	384:00	NO	YES	NO	23
TRVZN	12	11-5-14	2:30PM	408:00	NO	YES	NO	21
TRVZN	12	12-5-14	2:30PM	432:00	NO	YES	NO	20

TRVZN stands for trivalent zinc plating.
From table 2 it is resulted out that for EN19 & EN8D material black rust visible after 168 hours but no red rust & white rust found during testing continuously till 432 hours.

5.CONCLUSION

It is concluded from the result that :-

1.According to Visual reference for percentage of rust in case of without plating is 100% rust & is of rust grade D.

2. According to Visual reference for percentage of rust in case of with plating is 10% rust & is of rust grade 4.

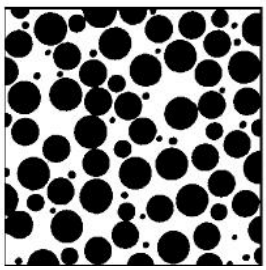
Fig.1:- 100%


Fig.2- Before salt spray test


Fig.3- After salt spray test


Fig.4- RUST GRADE D

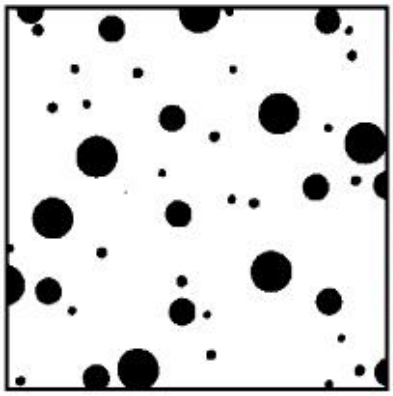

Fig.5:- 10%

Fig.6- Galvanized material. before test

Fig.7-Galvanized material after test.

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