

SURFACE PREPARATION IN MARINE APPLICATIONS USING SAND BLASTING

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ABSTRACT - In this paper, improving of surface roughness characteristics by varying blast angle and blast time on a mild steel marine substrate using sandblasting technique. In marine applications we are having much scope in this surface coating and surface preparation. In marine applications generally before applying of surface coatings initially we need to prepare the surface of the substrate. Sandblasting is one of the best conventional methods of preparing a substrate material surfaces before applying a coating or other finishes. It is the process of impelling a stream of abrasive material in a controlled manner against the substrate material. In sand blasting we can improve the surface finishing, where surface roughness plays vital role in surface preparation, by varying the blast angle and blasting time we can improve the surface roughness of the substrate. In this paper we will discuss about the Surface roughness characteristics by varying blasting time, blasting angle in sand blasting technique.

1.INTRODUCTION

The ships are made of various types of steels counting on the need, but mostly used is mild steel because of its advantages. While these ships staying over a period of time with in the sea there will be formation of biofoulings, corrosion and other unwanted particles. This resulting in high fuel consumption and plenty of other factors acquire consideration. To prevent this there will be a periodic maintenance of ships in the dockyards. During this maintenance they will remove all the biofoulings and other unwanted material. Sometimes they are going to repaint the ship to prevent the hull from corrosion. For this they have to get rid of all the previous paint on the ships hull. Again to repaint the surface we need to prepare the surface for better adhesion of the primers and paints. Sandblasting technique is one amongst the foremost widely used technique so, to attain efficiency we are considering blast angle and blast time for better surface preparation.

2. VARIOUS PARAMETERS IN SAND BLASTING:

There are various quite factors that make plenty of changes in surface modification. Some of these process factors are like blasting pressure, attack angle, blast time, coverage, stand-off distance etc.

Blast Time:

Blasting time is one of the parameters in the sand blasting process where the area covered on the substrate during blasting process with respect to time. For instance, if we consider that substrate is being fully blasted one time it means the time that takes to complete the blasting process.

Blast Angle:

Based on the substrate shape and properties by varying nozzle angles we can achieve various erosion rates and various surface roughness values. Depending upon the substrate we can vary the different angles accordingly.

Blast Pressure:

In the sand blasting process compressed air or gas is used to impel the blasting media onto the substrate. By mass flow rate of the media can be varied and can make a lot difference by varying blast pressure.

Stand-off Distance:

Stand-off distance is the distance between the nozzle exit and the substrate. If the blasting distance is the very small erosion rate is very much high and if the distance is too



high then erosion rate is very less so, to achieve optimum rate we need achieve better values.

3. EXPERIMENTATION

We have considered a mild steel substrate from a drydocked ship and performed our experimentation by varying blast angle and blast time. For blasting time parameter, we have used double venturi nozzle and for blasting angle we used different nozzle angles.

It is very important to use the correct size of grit for a blasting process. If the media is too hard or too large, the system won't work correctly and may leads to equipment damage and injuries may occur for the operator. Sulzer Metco VF Grit is the grit used. The set of process parameters chosen were based on the literature review as well with the following settings: angle at 45° - 90° , pressure between 60-80 psi. Surface roughness is measured using digital profilometer. By performing this experimentation process we have collected data and from this data we have generated graphs using mini tab software.

Data collected after experimentation:

Table1- Blast time and Surface Roughness Readings

TIME (min)	SURFACE ROUGHESS (µm)	SURFACE ROUGHESS (µm)	SURFACE ROUGHNE SS(µm)
	Sample1	Sample2	Average
1	1.26	1.31	1.285
2	2.73	2.79	2.76
3	3.19	3.21	3.2
4	3.94	3.95	3.945
5	3.69	3.71	3.7
6	3.36	3.42	3.39

Table2- Blast Angle and Surface Roughness Readings

ANGLE (degrees)	SURFACE ROUGHNE SS Sample1	SURFACE ROUGHNE SS Sample2	SURFACE ROUGHNES S Averege
45	9.12	9.18	9.15
60	9.18	9.22	9.2
70	9.25	9.29	9.27
75	8.84	8.92	8.88
80	8.54	8.56	8.55
90	8.92	8.95	8.935

4. SOFTWARE USED:

Mini Tab

For analyzing the data we have used mini tab statistical software 2021 version. Minitab is a software that helps to analyze data.

Interface of the software will be shown below in the figure.



Fig.1 Minitab Interface

Now we need to generate graphs from this software so, initially we need to insert the data in the worksheet cells is shown below in the figure.

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After inserting the data so we need to generate the graph for that we need to go to the graph's menu in the menu bar and we need to select the type of graph required for plotting and it is shown in the figure below.



Fig.3 Selection of graph type

We need to select the required graph model from the graph builder and then we need to give the inputs accordingly on X-axis and Y- axis.



Fig.4 Giving parameters on X&Y axis

By giving those X-axis and Y- axis inputs graphs will be generated accordingly. This software is also used for data interpretation, statistics calculations, prediction, analysis and many other things we can do on this software.



Fig.5 Generation of graphs

5. RESULT:

We have generated the data from the sand-blasting process and noted down in the Microsoft excel sheet and by using software mini-tab also we have generated the graphs from the subsequent data and graphs that are generated were shown below in the figures.



Graph-1 Surface Roughness vs Blast Time



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Graph-2 Surface Roughness vs Blast Angle

There is a popular method known as elbow method which is used to determine the optimal value of the given set of data. The basic idea behind this methodis that it plots the various values on the graph. The lesser number of elements implies closer to the centroid. So, the point where this distortion declines the less or most rapidly is that the elbow point. That declined elbow point is our optimum value.

By observing the above graphs using this elbow method we can attain the best results as optimum blasting time is 3 minutes and optimum blasting angle is 80° on a merchant ship which is made of mild steel but according to the substrate materialand by varying other parameters these may also varies accordingly based on the material properties.

6. CONCLUSIONS:

Surface Roughness of the ship hull should be in a optimal values, if the surface roughness increases abundantly then the friction between sea and ship increases which increases fuel costs. So, we should always have proper surface roughness accordingly. This Sandblasting is one among the most effective methods for surface preparations in marine industry and also, we will attain better efficiency by varying many parameters in sand blasting. Now a days various blast media also came to get better outputs.

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