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Comparative study of conventional blasting in Labuan Shipyard and Engineering (LSE): Reliability of recycled garnet

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ABSTRACT – Abrasive media is a key element in conventional blasting process. Despite the numerous types of abrasive media used in blasting, garnet remains popular in this surface preparation process. Garnet which is a semi-precious stone emits no known health hazard, a type of abrasive media that could be recycled for reuse. This study views the difference between new and recycled garnet and the result indicates that the profile achieve by recycled garnet falls a little short, as the garnet particles became smaller after the blasting process, however, it is still in the acceptable range as stated in the procedure of the construction project.

1. INTRODUCTION

Garnet which is mainly reddish in colour is a popular abrasive media used in surface preparation despite of the advancement in blasting technology. Labuan Shipyard and Engineering (LSE) utilize garnet as the abrasive media for blasting process in its blasting and painting line. This process is performed to protect materials against corrosion and one of the most costly procedures in a construction process. The process can also be called protective coating. Abrasive blasting is a method to remove rusts, mill scales and other foreign matter from the work piece and leaves an anchor pattern. Figure 1 shows the schematic diagram for the mechanism of blasting process employed by LSE.

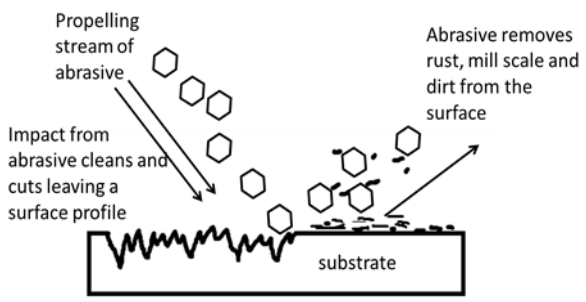

Figure 1 Mechanism of blasting process.

LSE has been using Indian garnet for its production line (Indian garnet loss 50% of its original size after blasting impact). Garnet are usually only used once (depending on client demands), if recycling of garnet is implemented, there are a lot of cost savings that can be generated, and reduce the usage of landfills. Furthermore, with proper calculation, optimization of abrasive usage could be established as stated as in others previous study [1], [2].

2. METHODOLOGY

2.1 Research Method

In analysing the properties of both new and recycled garnet, the data collection is divided into two categories of sample, the plates which have undergone conventional blasting process and also garnet sample of both new and recycled. The data collected is mainly performed in two phase namely on site phase and laboratory phase. The samples taken for this research is focused on an ongoing Floating Production Storage and Offloading (FPSO) project. A minor part of this project, called Siakap North Petai was performed in Labuan Shipyard and Engineering. The venue of on-site data collection was in the autoblast chamber of Labuan Shipyard and Engineering, the samples taken for this research comes from the material that is used for the construction of the FPSO project. Phase 1 of onsite data provides the rough data from usual quality control inspections, meanwhile the laboratory works provides a better insight on the new and recycled garnet.

3. RESULTS AND DISCUSSION

3.1 Garnet Properties

Particle size analysis was performed on the garnet sample of both new and recycled. The analysis was done using an image analysis method. The recycled garnet tends to have a shape which is round. This proves that the process of blasting, actually reduce the garnet particle shape, the sharp edges fractures and removed due the blasting process. The new garnet has more large particles compared to the recycled garnet which have more medium sized and fine particles. The garnet supplied should have mesh of 30 to 60 which are 0.595mm to 0.25mm respectively.

A density analysis was performed on both of the sample using pycnometer. The new garnet sample has the density 3.99 g/cm^3, meanwhile the recycled garnet has a density of 3.83 g/cm^3.

The SEM images justify the decrease in size of garnet particles after the blasting process. However, there are still some garnet particles that somehow still retain a large shape after the process.

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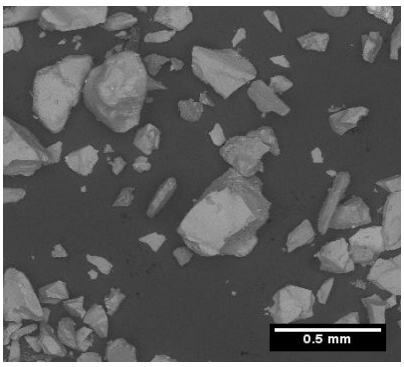

Figure 2 Close up SEM image of used garnet.

The XRD analysis of new garnet has a profile which can be thoroughly identified, however for the recycled garnet, most of it peaks were unable to be identified. The reason behind this may be that the elements of garnet undergo modification if it has been used in the blasting process. The impact and pressure from the blasting process may affect the abrasive in use, not just in terms of its size but also its elemental constituents. Other than the impact of blasting process, there is also a possibility of the recycled garnet being contaminated.

3.2 Plate (substrate) Samples

A small sample was made to be analyze using 3d imaging equipment, Alicona. The result leads to better insight and visually represents the difference in the surface of material after blasting process. A surface profile plotting was done on approximately 1cm of each sample which was blasted. The parameters of roughness were obtained through this experiment. For the profile made with new garnet, the mean peak to valley height of roughness profile is 44.374µm. For the profile made with recycled garnet, the mean peak to valley height of roughness profile is 36.279µm.

Figure 3 represents the jagged profile of the substrate after the blasting process. It can be clearly justified that the sample blasted with new garnet offers a deeper surface profile compared to the sample blasted recycled garnet.

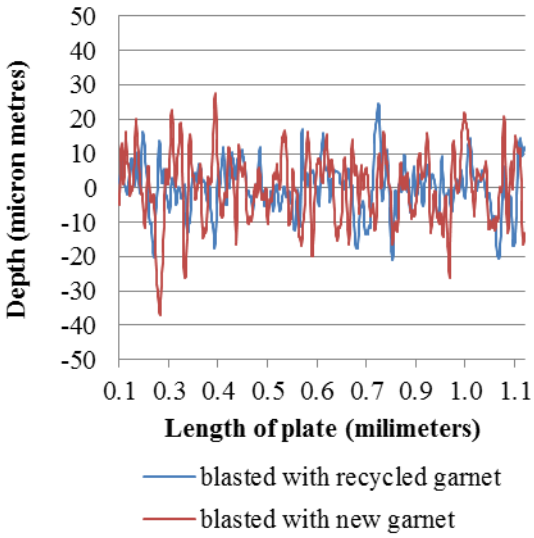

Figure 3 Result of surface profile from Alicona analysis.

4. CONCLUSION

Through this study, the difference between both new and recycled garnet can be clearly depicted. Referring back to the significance of the study, in determining the usage of recycled garnet with accordance of standards, it is safe to say that a recycled Indian garnet of mesh size 30/60, could well achieve the profile depth of 32 to 68 µm, according to the Siakap North Petai project surface protection procedure, the surface preparation should be according to the customer specification requirement which was in the range of 40 to 80 µm.

5. REFERENCES

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