



IMPROVED QUALITY OF ALUMINUM CASTING CRAFTS PRODUCTS THROUGH IMPROVED ELECTROPLATING

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ABSTRACT

Small and Medium Enterprises (SMEs) in Juwana Pati, Central Java has been contributing greatly to the economy in Indonesia. One of SME products in the form of handicraft from aluminum castings. Product marketing covers major cities in Indonesia and ASEAN, such as Thailand, Malaysia, and Singapore as tourist destinations, both domestic and foreign tourists. However, the quality of handicraft products is still low to cause the product is less preferred by consumers. The main problem faced in producing this aluminum casting craft is to have a low hardness level of 59 HRB, and less attractive colors. The purpose of this research is to improve the quality of aluminum casting crafts products through the improvement of metal coating process, especially increasing hardness so as to increase the amount of export. The applied method is to analyze the effect of nickel and copper coating current on hardness, and to analyze the effect of coating time on nickel and nickel + copper on hardness. The result can be that the hardness can be increased up to 20% by electroplating process using 5 ampere current for 10 minutes.

Keywords: improved quality, export product, aluminum casting handicraft, copper electroplating.

1. INTRODUCTION

The role of SMEs is very important in Indonesia. This is proven when Indonesia faced economical crisis during 1997-1998. During the crisis, big industries hardly survived. In the other hand, micro industries and cooperatives could survive. They even developed better. Thus, SMEs is considered to have an important role in building country's economy [1]. This can be seen from its excellences which are: (a) flexible and adaptable to market's demand; (b) able to create job vacancies faster than other sectors; (c) having wide diversification to contribute significantly in export and commerce.

One of the small and medium industries that contribute significantly to Indonesian economy is an industry of aluminum casted craft which is located in Juwana Pati, Central Java, Indonesia. The product variations produced are Europe mask, budha mask, king mask, ashtray, lizard, fruit, etc. Generally, the product marketing of this aluminum cast craft is based on order. Thus, it goes through many ups and downs. In a month, the sale can reach up to 7,000 products. The domestic product marketing copes big cities like Semarang, Surabaya, Yogyakarta, Bandung, Jakarta, and Bali. The exporting market goes to some ASEAN countries such as Thailand, Malaysia, and Singapore. Those countries are tourist destinations both domestic and international. Previous studies have shown that in developing their business, the small and medium industries in Indonesia face problems both internally and externally. In craft industry of aluminum casting, the problem faced is on technology. The craft products are sold still in their original condition which is aluminum colored. This causes the products to be easily scratched and dull. As the result, their appearance is less interesting as shown in Figure-1.



Figure-1. The craft products with their original aluminum color.

The goals of this science and technology program for exporting product activity are to improve the aluminum casted craft's product quality, order financial management, and increase product marketing. Therefore, solutions are needed to improve a product's quality by using electroplating technology. By applying the solution, it is hoped that competitiveness, income, and prosperity of the employer and employees increase.

2. THEORETICAL FRAMEWORK

Craft products made from aluminum casting are not scratchproof because they have a low hardness which is around 59 HRB. Aluminum goes through an oxidation process which produces oxide aluminum substance (Al_2O_3) which is blackish and it makes the product's performance less interesting [2]. In order to make the product to be scratchproof and corrosion resistant, advanced finishing needs to be done by doing metal



coating process. Metal coating technology is done to protect the product from corrosion [3], shape hardness on a product's surface, fix technical or certain mechanical characteristic, and give decorative value to basic metal [4]. The most suitable material to coat is aluminum because it is electric and heat conducting; and easy to be shaped and found [5].

3. MATERIALS AND METHODS

Equipment used in this science and technology program for exporting product to improve product quality is metal electroplating tool as shown in Figure-2 which has a specification of a maximum volt of 15 volts with 150 Ampere maximum current. The material used for aluminum electroplating is used aluminum. There are two kinds of electroplating material: (1) shiny color electroplating materials which are nickel and cuprum; (2) antique color electroplating material which is cuprum coating and bronze.

The applied method is to analyze the effect of nickel and copper coating current on hardness, and to analyze the effect of coating time on nickel and nickel + copper on hardness.

4. RESULTS AND DISCUSSIONS

The product quality of aluminum casting can be improved through metal electroplating process in order to give protection towards corrosion, shape surface hardness, fix certain technical and mechanical characteristics, and give decorative value to its basic metal which is aluminum [6]. After the metal electroplating process done with a variation of nickel and copper electroplating, there is an improvement in mechanical characteristics [7] [8].

The result of the previous research that used a specimen which was in form of plate/solid coin resulted from aluminum casting with an average preliminary hardness of 59HRB shows that the higher the current or the longer the electroplating process, the higher surface hardness as shown in Figure-2, Figure-3 and Figure-4.



Figure-2. The test of nickel + copper electroplating hardness.

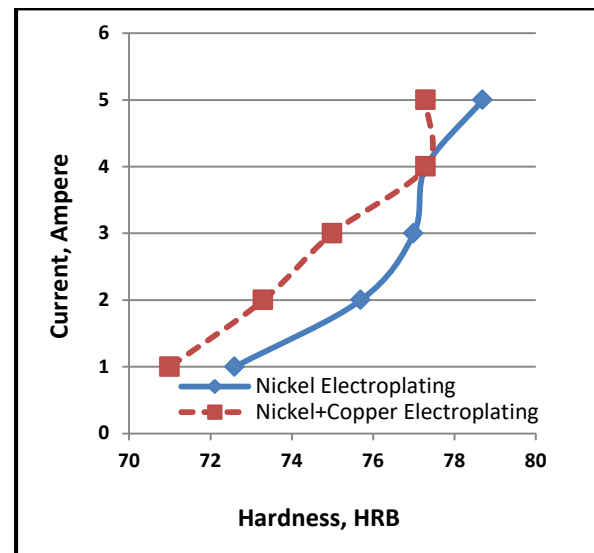


Figure-3. The graphic of the influence of nickel and copper electroplating towards hardness.

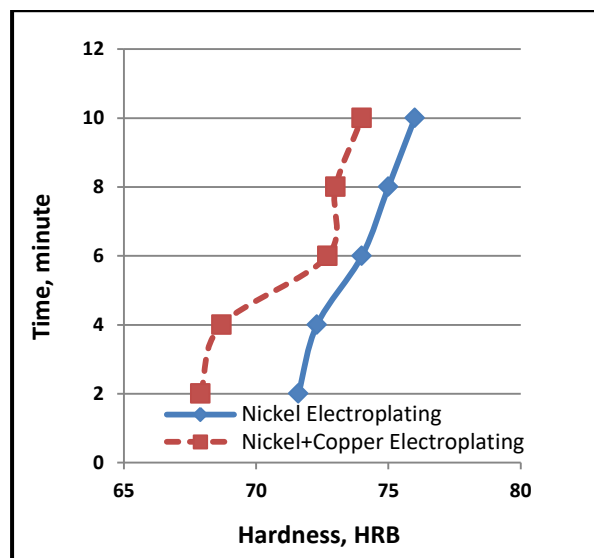


Figure-4. The graphic of the influence of nickel and copper electroplating time towards hardness.

With the current of 1 Ampere, the average hardness on nickel electroplating is 72.6 HRB, while the average hardness on nickel and copper electroplating is 71.0 HRB. With the current of 5 Ampere, the average hardness is 78.7 HRB and 77.3 HRB. With 2 minutes of electroplating time, the average hardness on nickel electroplating is 71.6 HRB while on nickel and copper electroplating it is 67.0 HRB. In 10 minutes, the average hardness is 76.0 HRB and 74.3 HRB. The total average hardness is 71 HRB. Thus, the increase of average hardness is 20 %.

The process of copper electroplating in the SMEs of aluminum casting craft is described in diagram Figure-5 below.

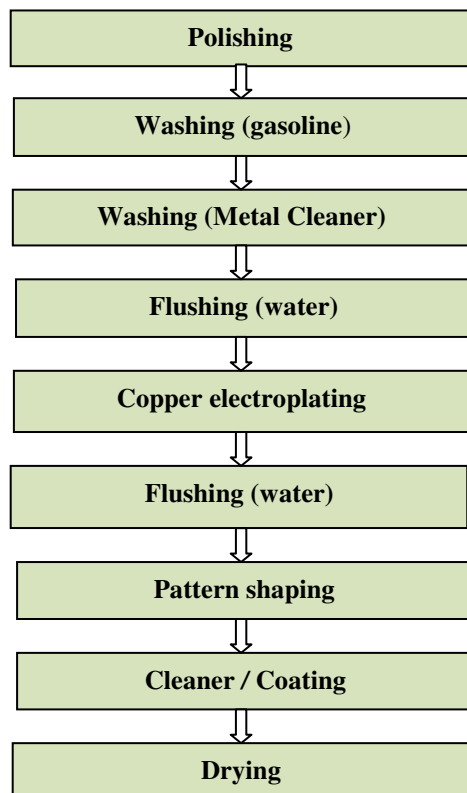


Figure-5. Diagram of copper coating flow process.

The result shows that by adding copper as a coating layer, the product's surface is scratchproof and they are also more interesting. The average hardness before electroplating was 61 HRB. After the copper electroplating process, the average hardness increases to 70 HRB or around 15 %.



Figure-6. The test on products hardness of aluminum casting craft.

By adding the process of copper electroplating on aluminum casting craft products, there is 29.5 % increase of additional value followed by 14 % increase of selling income. The increase undoubtedly increases the industry's profit. The increase of the products' decorative value is shown in Figure-1 and Figure-7.



Figure-7. SMEs craft products of copper electroplating.

5. CONCLUSIONS

Improved quality of Aluminum Casting Crafts Products through Improved The most optimized electroplating process conducted at 5 ampere current within 10 minutes resulted in an average hardness of 76.0 HRB or an increase of 20%.

ACKNOWLEDGMENTS

We as IbPE Program Implementation Team would like to thank all those who have helped implementation of these activities, among others: Ir. Supriyadi, M.T, as Director of Politeknik Negeri Semarang, Nur Budiono, as the owners of SMEs "Budi Jaya Logam", Warsito, as the owners of SMEs "Prima Logam& Antique", and All Lecturers and staff techniques in the Department of Mechanical Engineering Politeknik Negeri Semarang We realize that there are still many shortcomings in community service activities in this IbPE Program. To this end, we expect criticism and constructive suggestions for the sake of this article improvement. Hopefully, this article can be useful for all readers.

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