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ENGINEERED OVEN AS AN ALTERNATIVE METHOD ON STAMP *canting* SOLDERING PROCESS

Oven Rekayasa Sebagai Metode Alternatif pada Proses Pematrian canting Cap

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Kata kunci: batik, canting cap, oven, pelelehan patri

ABSTRACT

batik is a process of attaching wax on to a fabric to block color. This process is done using a tool called *canting*. There are two kind of *canting*, writing *canting* and stamp *canting*, that is respectively use to make written *batik* and stamp *batik*. Stamp *canting* was made to accelerate the process of making *batik* fabric with the standards of *batik* itself. It was made using copper that is stacked in certain way and burned on a pile of charcoal to ensure the adhesive material (*patri)* melt. This research aims to accelerate the process of soldering stamp *canting* using engineered oven instead of charcoal. the oven engineered in this research uses Liquid Petroleum Gas (LPG) as the main heat source. It was made not only to accelerates the process, but also to make sure the consistency of the heat along the process of burning which will directly affecting the end product of stamp *canting*. The method used in this research includes: literature studies, field studies, oven engineering, making *canting* samples, test, and reporting. The result of this research shows the oven was able to reach the temperature to melt standardized *patri* on stamp *canting*, therefore able to be an alternative method in creating stamp *canting.*

ABSTRAK

batik adalah proses menempelkan lilin pada kain untuk merintang warna. Proses ini dilakukan menggunakan alat yang disebut canting. Ada dua jenis canting, canting tulis dan canting cap, yang masing-masing digunakan untuk membuat batik tulis dan batik cap. canting cap dibuat untuk mempercepat proses pembuatan kain batik sesuai dengan standar batik itu sendiri. canting cap dibuat menggunakan tembaga yang ditumpuk dengan cara tertentu dan dibakar di atas tumpukan arang untuk memastikan bahan perekat (patri) meleleh. Penelitian ini bertujuan untuk mempercepat proses pelelehan patri canting cap menggunakan oven rekayasa tanpa arang. Oven yang direkayasa dalam penelitian ini menggunakan Liquid Petroleum Gas *(LPG) sebagai sumber panas utamanya. Oven ini dibuat tidak hanya untuk mempercepat proses, tetapi juga untuk memastikan konsistensi panas sepanjang proses pembakaran yang secara langsung akan mempengaruhi produk akhir canting cap. Metode yang digunakan dalam penelitian ini meliputi: studi literatur, studi lapangan, rekayasa oven, pembuatan sampel canting, percobaan, dan pelaporan. Hasil penelitian menunjukkan oven mampu mencapai temperatur yang dibutuhkan untuk melelehkan patri standar pada canting cap, maka oven dapat digunakan sebagai metode alternatif dalam pembuatan canting cap.*

INTRODUCTION

Batik is a cultural masterpiece of Indonesia. It was a traditional way to create motifs on a fabric. National Standard of Indonesia (SNI), SNI 0239-2014 stated that *batik* is a handicraft resulted from blocked coloring process using hot *malam* (*batik* wax) as the color blocker that is attached using *canting tulis* (writing *canting*) and or *canting cap* (stamp *canting*) to create certain meaningful motifs (BSN, 2014). SNI 0239-2014 also define stamp *canting* as a motif shaping tools made from cooper or wood used to paste *malam.*

Batik importance is more than a product. Since UNESCO declared *batik* as the Intangible Cultural Heritage of Humanity of Indonesia, *batik* became a tool of diplomacy. Zahidi (Zahidi, 2017) in his paper stated that Indonesian government promoting *batik* as a soft power instrument throughout Southeast Asia. This momentum has been beneficial for a lot of *batik* SME(s) in Indonesia. But within every chance, there is also a challenge follow behind. In this case, the challenge was to match the demand of the ever-growing market for *batik*.

Batik is a unique process that leads to a unique product. To produce a massive amount of *batik* product, many craftsmen is needed. Since *batik* is not something that can be done easily not many people are able to create a high-quality *batik*. To be able to create a decent *batik*, a person should have a decent amount of experience, therefore a regeneration is needed. The problem faced by *batik* community as of now is lack of regeneration for *batik* craftsmen (Oentoro, Amijaya, & Seliari, 2019). Oentoro (Oentoro et al., 2019), in his research shows that *batik* craftsmen in an area of Yogyakarta are above 40 years old. It means that no young people making *batik* right now. This problem as of right now might only affecting the production capability of *batik* industries, but in a long term this could lead to an extinction of *batik* itself. One thing that becoming a primary concern right now is to continuously produce and preserving as our cultural heritage,. A regeneration is needed.

While it is true that regeneration is the main concern for *batik* to keep existed as Indonesian cultural heritage, there are other problem looming. One of those problem was the global competition to fulfill market's demand for *batik*. Other countries try to create a *batik*-motif fabric to fulfil those specific demand. The information regarding real *batik* is very limited to foreign countries and even to our local people. Many people knew *batik* only as the motif from certain region. This misconception of *batik* made *batik* compete with *batik*-motif fabric that is cheaper. With this in mind, a lot innovations have been made to make a process of making *batik* easier while still on the corridor of craftmanship. Many of those innovations were made for the *canting*.

There are two kind of *canting*, that is writing *canting* and stamp *canting*. Some innovations made for writing *canting* includes electric *canting* (Lestariningsih, Dharmastiti, & Moyoretno, 2013; Syamsuri & Abidin, 2016) and automatization of written *canting* (Ikawanty, Rifa'i, & Patma, 2015). While for stamp *canting*, the innovations includes creating stamp *canting* from other materials such as duplex paper (Nurohmad & Eskak, 2019), cardboard

(Yanuarmi, Widdiyanti, & Sundari, 2019) and wood (Hastuti, 2010). The innovations are not limited to material selection, many have tried to use more sophisticated method such as CNC milling machine (Hermawan & Suwondo, 2014), electroplating (Setiawan et al., 2020) and even using additive manufacturing (Hamidi, Wibisono, & Dharma, 2017). Although there are two well-known (wood and cooper) materials for making stamp *canting,* but most *batik* craftsman chose cooper as their main material. The main reason behind that selection is that cooper have better conductivity than wood, which directly affect the result of *malam* stamping.

Despite the superior thermal properties of cooper compared to other materials for this application, it has its own drawback. Shaping and assembling cooper into a fully functioning stamp *canting* is not an easy task. Making stamp *batik* is a long and complex process that need a certain knowledge, experience, and expertise. It could take up to one week for an expert to create one stamp *canting*.

Cooper is still the most favorite materials to create stamp *canting*, but it has one downside in its making process. The complexity of the motif is one reason for the long process time, the other one is the burning process. Those drawbacks worsen by a lack of stamp *canting* expert regeneration, thus push researcher to innovate in a more efficient and effective ways to create stamp *canting* using cooper.

In general the process of making stamp *canting* from cooper starts from preparation, frame making, attaching metal motifs, assembling motifs to the frame and handle, and finishing stamp *canting* designing the motif, identifying each size (frame size, thickness of the motif, etc.) (SKKNI, 2018). There are two separate processes between motif making and assembling it onto the frame, the former uses *patri* with higher melting temperature while the later uses a lower one. Those differences were made deliberately to make sure a higher success rate of making the stamp *canting*.

Traditional way of making *canting* includes soldering process using stacked charcoal (Figure 1). Those charcoal then burned until it smolders. The motif then put onto the smoldering charcoal and burned until it is done. Knowing that a stamp *canting* soldering is done was not an easy job, since the craftsmen usually use only their eyes to see the smokes coming up from the stamp *canting*. An inexperience craftsman might pull out the stamp *canting* too late and actually broke the whole process. The duration of the process itself, from preparing the charcoal until it finishes the product, could take up to an hour.

In this research we conducted an alternative method for soldering the stamp *canting* so it will take shorter time and easier to visually detect whether the process has been done or not. Using an engineered oven that using LPG as its source of heat.

Figure 1. Conventional soldering process of stamp *batik*

METHODOLOGY

Materials and Tools

a. Stamp *canting* making
   Materials: flux, local *patri*, standardized patri (brazzing rod) by Harris, 0.5 mm thick copper plate.
   Tools: little tweezer, big tweezer, copper plate cutter, bow compass, clamp, steel saw, fail, brass
b. Oven making
   Materials : 0.3 mm thick steel plate LPG burner, refractory stones, fireproof cement, heat retarder, connector, regulator, thermocouple.
   Tools : electrical welder machine set

To use the brazing rod, it was crush into pieces before we put in on the samples. The technical detail of Harris's *patri* shown on table 1. While the composition and technical specification of the local *patri* is unknown.

Table 1. Technical detail of Harris *Patri* (Harrisproductsgroup, n.d.)

Chemical Composition	Solidus Temperature	Liquidus Temperature
Cu - 92,75% P - 7,10% Ag - -% Others - 0,15%	1310° F 710° C	1475° F 802° C

Making the Oven

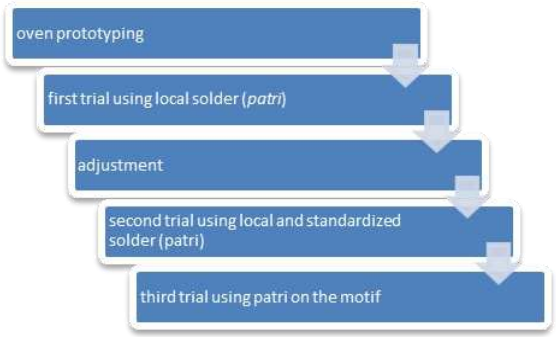

Figure 2. Flow diagram of research method

Flowchart of this research is shown on Figure 2.

Dimension are considered to be the most important thing to consider when creating this oven. Most of stamp *canting* has a size of 20 x 20 x 4 cm. In order for the oven to be able to contain those, it has to have a chamber with a bigger dimension than 20 x 20 x 4 cm.

The oven created in this research has a dimension of 40 x 40 x 40 cm with gas (LPG) as its main source of heat. Traditional method of stamp *canting* making uses coal as its main energy source to heat and "cook" the *canting*. While it is still effective, but it needs a lot of time to be burned, let alone to "cook" the stamp *canting*. To overcome that problem, we use gas (LPG) to heat the oven. The fire will be put directly into the chamber to heat the stamp *canting* inside it. Heating stamp *canting* inside the chamber is hoped to create a more homogenous heat all across the stamp *canting*.

On the first design, the burner was placed on the side of the oven, assuming that the heat will stay inside and spread evenly inside the oven. After a few tests, the burner was adjusted to the top of the oven. the fire will enter the oven chamber through this nozzle and heat the topside of the *canting*.

Testing the Oven

The oven was tested by using it to burn several stamp *canting* motifs. The motifs were treated using local *patri* and standardized *patri* from Harris. The uses of two kind of *patri* was intended to indicated the heat generated by the oven system.

RESULTS AND DISCUSSIONS

Oven Making

The specification of the oven is stated on Table 2.

Table 2. Specifications of the oven

Specification	Dimensions
Length x width x height	400 mm x 400 mm x 400 mm
Plate thickness	3 mm
Refractory thickness	55 mm
Exhaust	(D) = 29 mm, length = 50mm
Burner diameter	5,2 mm
Hollow metal(l x w x h)	40 mm x 60 mm x 420 mm.

The oven was successfully created and able to generating heat. The physical appearance of the oven can be seen in Figure 3. The oven was created to accommodate the process of making stamp *canting*, especially the size of stamp *canting* that is considered normal that is 20 cm x 20 cm.

Figure 3. Oven for stamp *canting*

First test

First test was conducted using local *patri* to solder the motif. The motif with *patri* pasted on its joint was burned for 10 minutes, 20 minutes, and 30 minutes. After every interval, the motif was inspected visually to see whether the *patri* has already melted or not. After 30 minutes, as shown on Figure 3, the *patri* was not perfectly melted. it was balled up which was a signed of lack of heat in the oven.

Second test

At first, the burner with 3 nozzles was built on the side of the oven, but after the first tests, it was proofed to provide the oven chamber with enough heat to melt local *patri*. Since adding another nozzle means making this oven from the beginning, an adjustment was made to put more heat on the samples by rotating the oven and relocating the nozzles position to the top of the oven. It was analyzed that the heat generated from the burner located on the side of the oven was not enough to melt the *patri* on the motif, therefore the burner was relocated and the samples position inside the chamber was heighten using bricks and metal net (Figure 4). The purposed of this adjustment was to make sure that the fire axis hit directly onto the samples.

Figure 4. The oven after adjustment

The samples were analyzed to assess the effectivity of the adjustment. From Figure 4, it can be seen that the *patri* from both samples were not completely melted. a granule-like shape was visibly seen on almost every joint on both samples. That visual appearance is a result of a lack of heat inside the oven which creating an imperfect soldering. Since the oven was not created with built in thermometer, there is no way to pin point the process temperature inside the oven. to analyzed the oven even further, a Harris *patri* was used in the process (Figure 5).

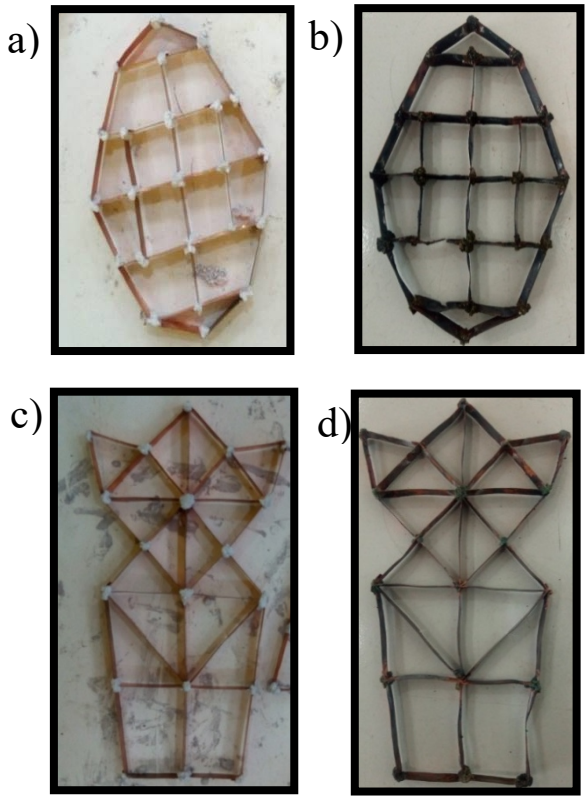

Figure 5. a) sample motif a before process; b) sample motif a after process; c) sample motif b before process; d) sample motif b after process

After the first test that resulted in a failure of the *patri* to melt, another test was conducted using standardized *patri* from Harris (US 2005/0249629 A1, 2005). The test was design to create some distinct visual differences between two kinds of *patri*, one from Harris that is standardized and the other from local store. A mesh of copper was made and given two different *patri* on each side. That sample was then burned and inspected every 10 minutes. The result of said process shown on Figure 6.

After 20 minutes, the samples already shown a distinct visual appearance in which the left side of the sample (with Harris *patri*) was visibly better than its right side. From this conclusion, two statements were made: Local *patri* have a higher melting temperature than 802°C and the adjustment was able to create stamp *canting* using standardized *patri* from Harris. Based on that statement, we conduct the third test/*patri* on motif test.

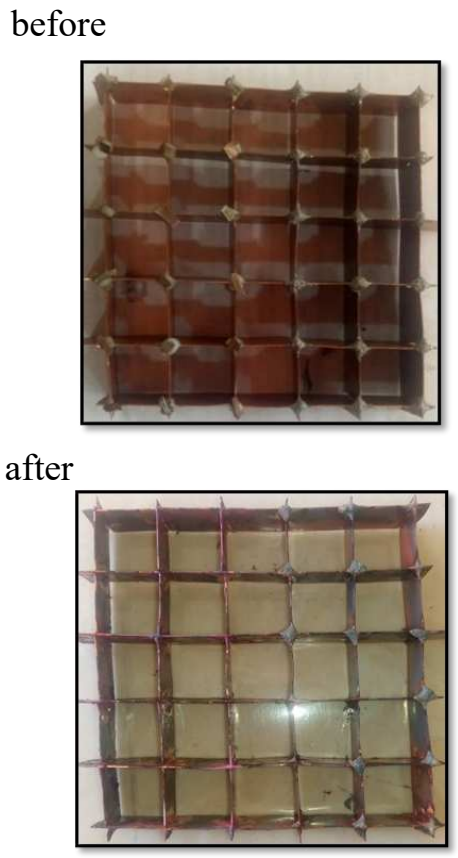

Figure 6. Second test (using 2 (two) different kind of *patri*: Harris *patri* on the left side and local *patri* on the right side)

Third Test/*Patri* on Motif Testing

The third test was conducted to know the ability of the engineered oven capability to melt *patri* on motif joint and the time needed to do it. Based on the result of second test, Harris's *patri* was used to complete the soldering process of making stamp *canting* motif (11 cm x 11 cm) and handle. The heating process conducted for 10 minute that is, based on the result of the second test, concluded as the optimum duration of heating for soldering using Harris's *patri*. The 10 minutes duration for soldering process in stamp *canting* making is a significant improvement. On the conventional method of soldering, it will take around 20 minutes just to melt the *patri* (Sangaji, 2017). With this oven, the preparation time needed to do soldering process, such as stacking the charcoal and metal net, could be skipped. The visual appearance of the third test can be seen on Figure 7.

Figure 7. Third test using Harris's *patri* (upper picture set shown the motif and handle before soldering process; bottom picture shown the motif and handle after soldering process)

The motif and handle in the third test were put into the oven for about 10 minutes. After 10 minutes, the samples were then taken out of the oven and being observed visually. The result was the *patri* succeeded to melt perfectly into the joint of the samples. The oven was able to made a motif and handles of stamp *batik*. however, to create a whole and fully functional stamp *canting*, a different kind of *patri* with lower melting temperature was needed. Since such *patri* is not something that is normal in the market, therefore further research about low-melting temperature *patri* should be conducted.

CONCLUSION AND SUGGESTIONS

Conclusion

The oven was able to finish the soldering process for stamp *batik*. Using Harris's *patri*, 10 minutes was needed to create a motif and handle joint glued together. It was a significant improvement from a traditional way soldering process for stamp *canting* where it could take up to 1 hour from start to finish. The heat consistency making it possible for the *patri* to be perfectly melted all across the motif.

Suggestions

Further research about low-melting temperature *patri* should be conducted. Some improvement for the oven should be made, especially adding a thermometer and the amount of burner for the oven.

AUTHOR CONTRIBUTION

Every writer on this paper is a primary contributor.

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