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Study on the Temperature Distribution for Mold Heating Process

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ABSTRACT: In the plastic injection molding process, the product is formed in a very short time, the selection of the optimal parameters (temperature) to make the filling process of liquid plastic takes place easily, quickly, and reducing. defects of plastic products, especially for products of small thickness (thin walls) and large lengths. With this study, the authors will simulate the process of heating the cavity with hot air integrated inside the mold, then bring water into the mold cooling system, change the mold temperature, to learn and evaluate heating process and cavity cooling process with the thickness of the insert. After the experiment, find the most suitable insert temperature. Through the research process, it was found that the heating process at 20s with a heating temperature of 400 ° C, the highest value of about 153^0C with the insert plate thickness is 0.5mm.

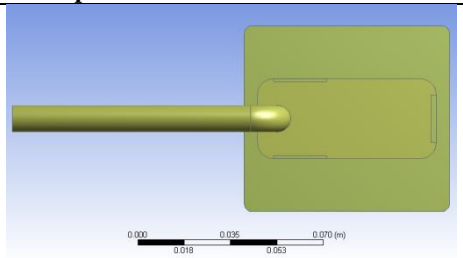
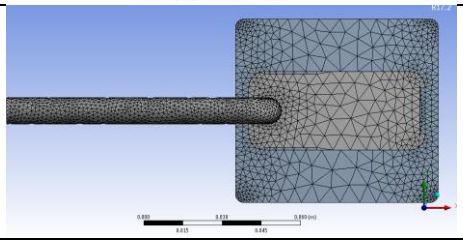
KEY WORDS: Injection molding, injection pressure, melt flow length, mold temperature, melt temperature.

I.INTRODUCTION

In the field of processing and manufacturing of plastic products, plastic injection method is one of the most used method, especially for products with large length and small thickness, so if there is no experience in choosing the mold temperature, as well as the investment in mold temperature control devices, product defects will easily appear during injection molding, On the contrary, if the mold temperature is reasonable, the process of balancing the flow of plastic into the mold cavity will be done more easily. This is an important basis for achieving uniform quality for a large series of products in the plastic injection production process, especially for molds with many different sizes of molds.
This study will focus on simulating the heating process for the mold cavity, to find out the difference in temperature before and after heating, as a basis for calculating the appropriate mold temperature for each plastic, and plastic flow length.

II. SIMULATION METHODS

ANSYS CFX is the most popular and commonly used fluid dynamics analysis module that can help to reliably and accurately simulate different types of fluid flows.

Content	***Description***	***Parameter***
1. Geometry		- Inlet - Outlet1 - Outlet2 - Outlet3
2. Mesh		- Inflation + Geometry: 2 Bodies + Boundary: 1 face + Maximun Thickness: 1mm

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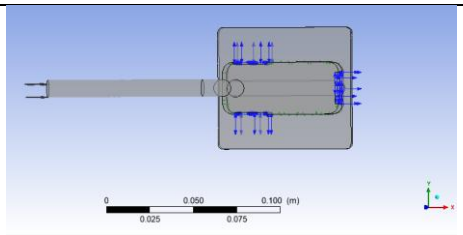
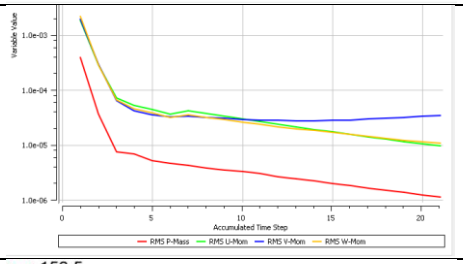
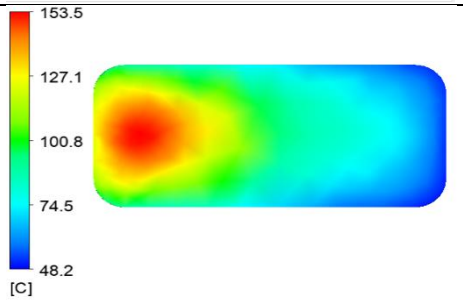
3. Setup		- Air (U, V, W=0, P=0, T=30°C) + inlet (Normal Speed: 100m/s, Static temperature: 400°C) + Outlet (Opening temperature: 30°C) - Stamp (Material: stell, temperature: 30°C) - Output (Time interval: 0.1s)
4. Solution		- Start run
5. Results		- Stamp side: + Model: Variable + Variabel: Temperature + Range: Use Spectified - Default Legend View 1 + Title mode: Variable + Precision: 1 - Fixed

Figure 1: ANSYS simulation process.

III. RESULTS AND DISCUSSION

Research on the temperature distribution of the mold cavity after heating with hot air from internal the mold with gas inlet air temperature of 400°C, heating time 20s, and steel cavity surface by simulation

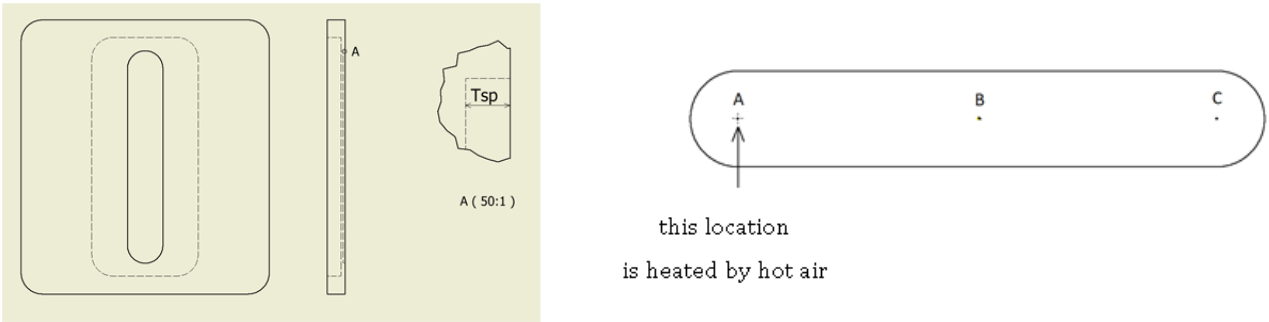


Figure 2: Mold cavity with heating surface

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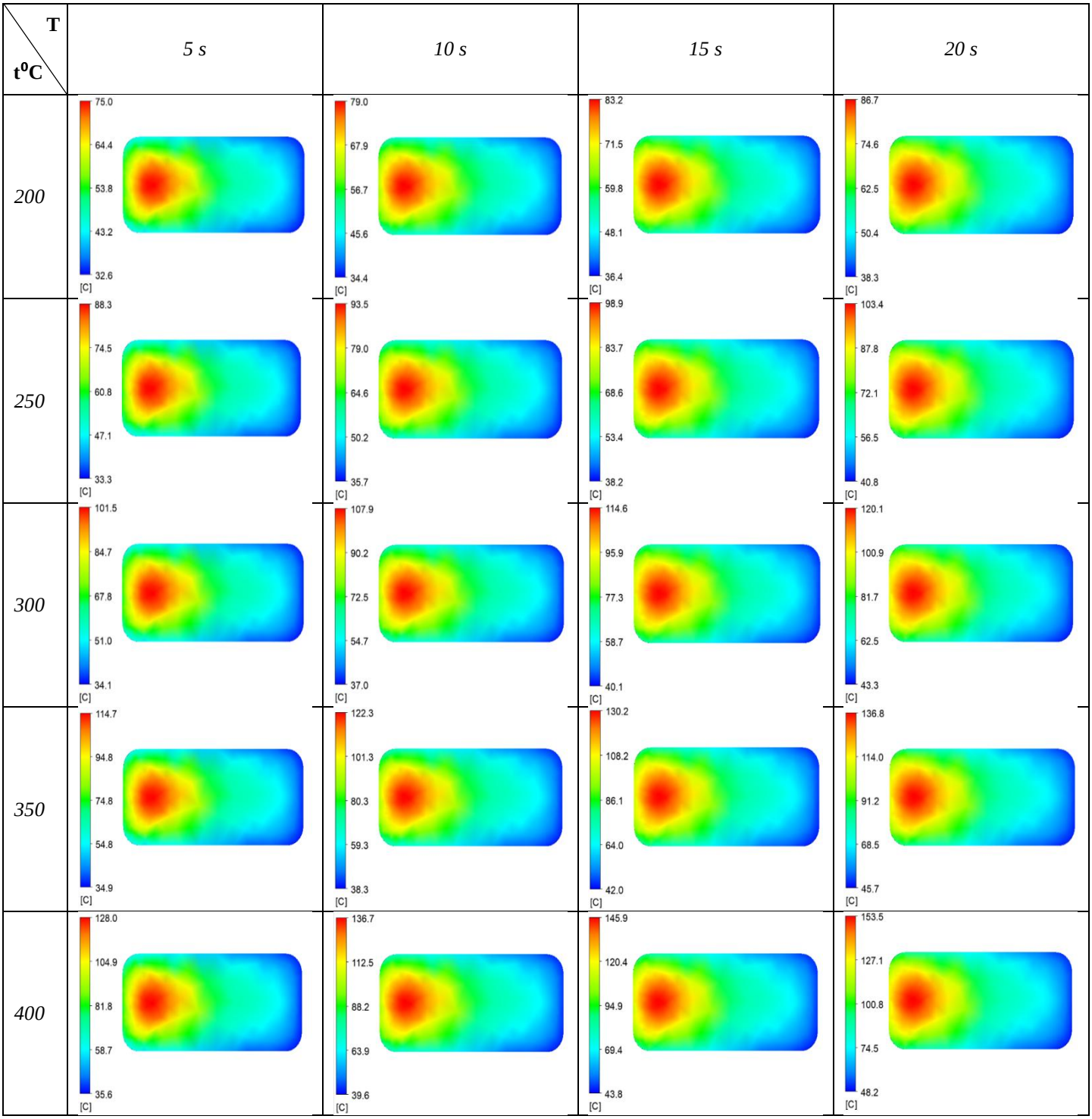

Figure 3: Mold temperature distribution after heating time by simulation mold cavity with heating surface with thickness of stamp *insert* is 0.5mm

+ Highest temperature at spraying position in case of spraying temperature of 400^0C and spraying time of 20s is 153.5^0C, further away from lower temperature.

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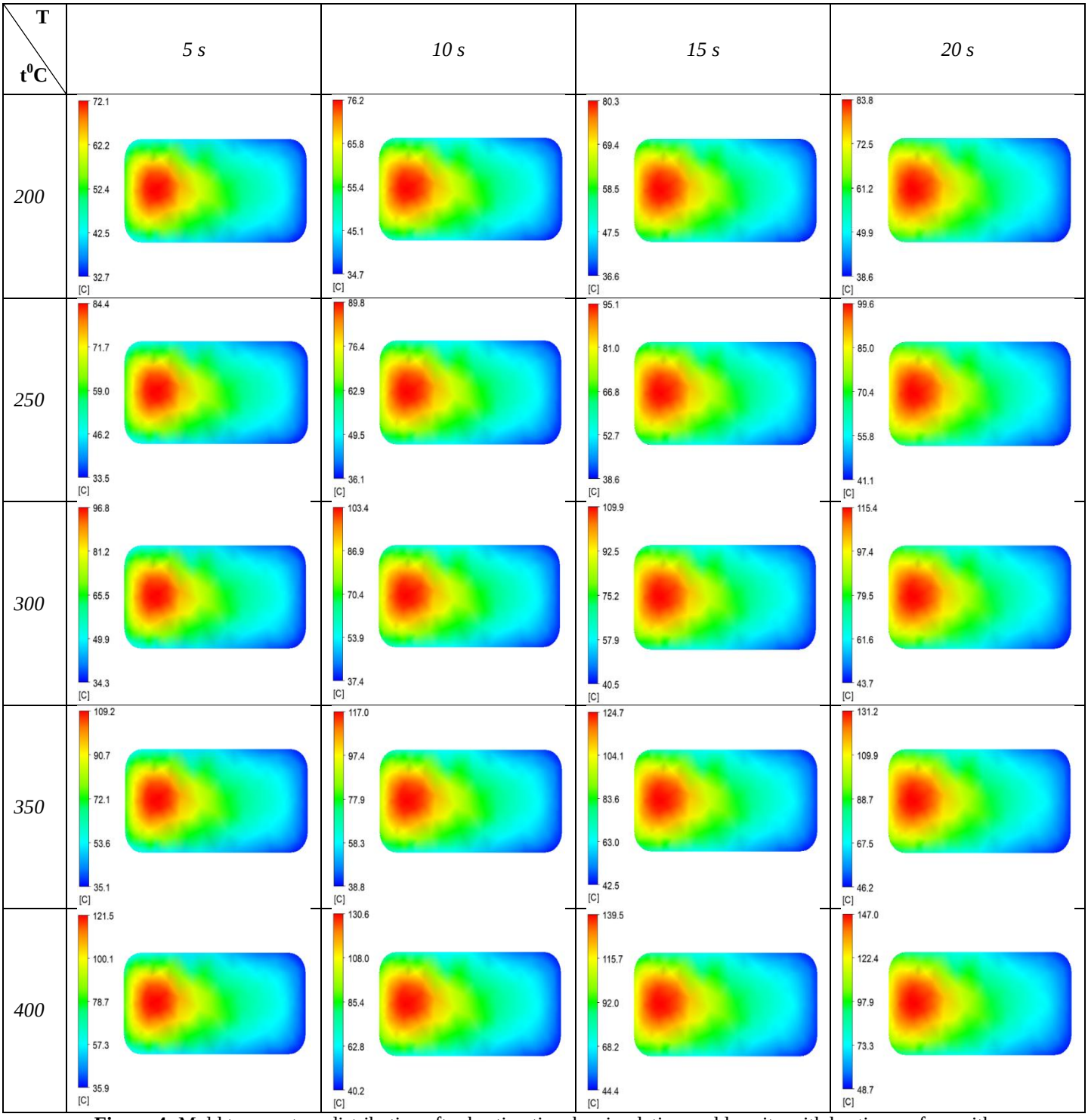

Figure 4: Mold temperature distribution after heating time by simulation mold cavity with heating surface with thickness of stamp *insert* is 0.3mm

+ Highest temperature at spraying position in case of spraying temperature of 400^{0}C and spraying time of 20s is 147^{0}C, further away from lower temperature.

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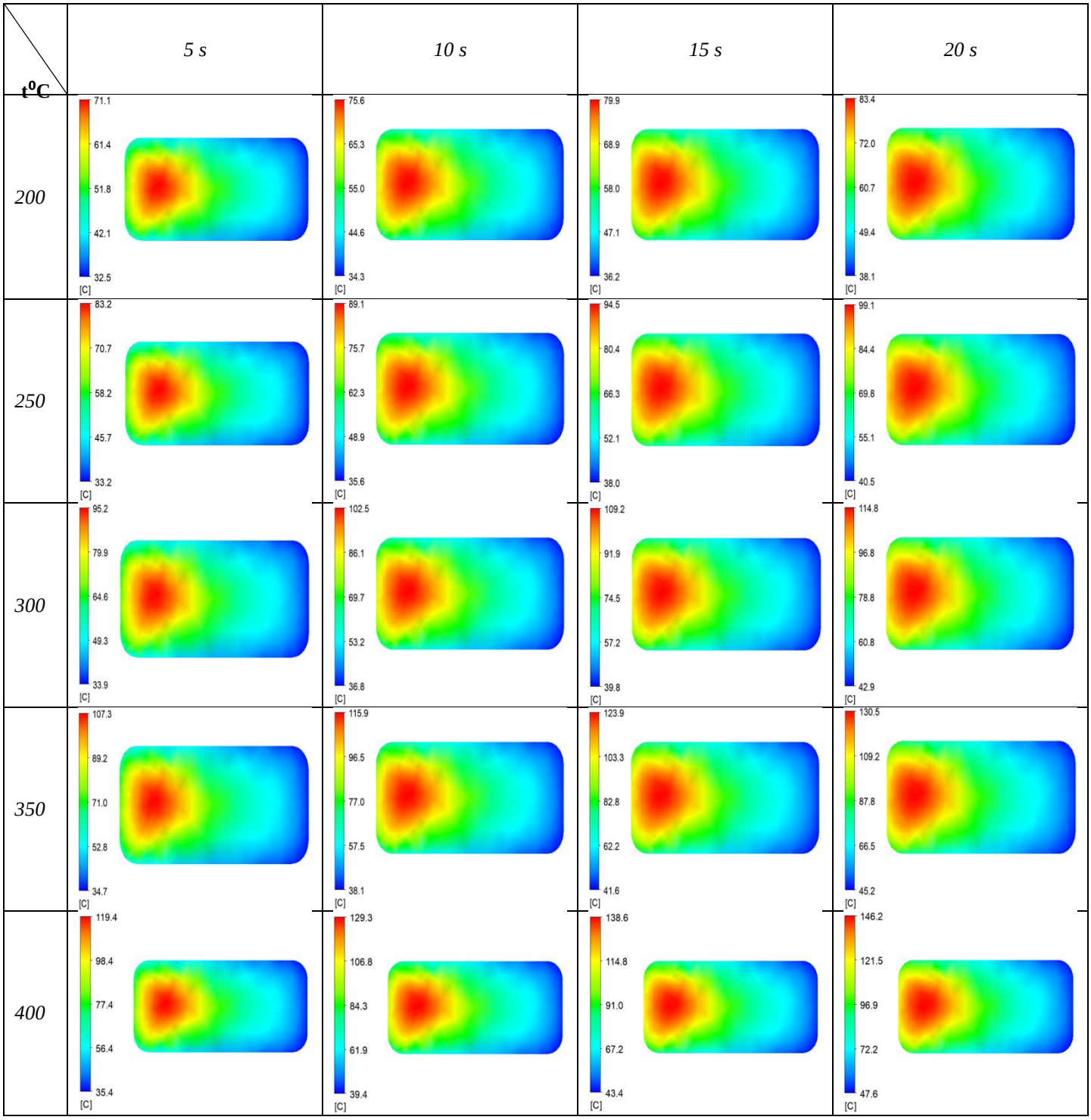

Figure 5: Mold temperature distribution after heating time by simulation mold cavity with heating surface with thickness of stamp *insert* is 0.1mm

+ Highest temperature at spraying position in case of spraying temperature of 400^{0}C and spraying time of 20s is 146,2^{0}C, further away from lower temperature.

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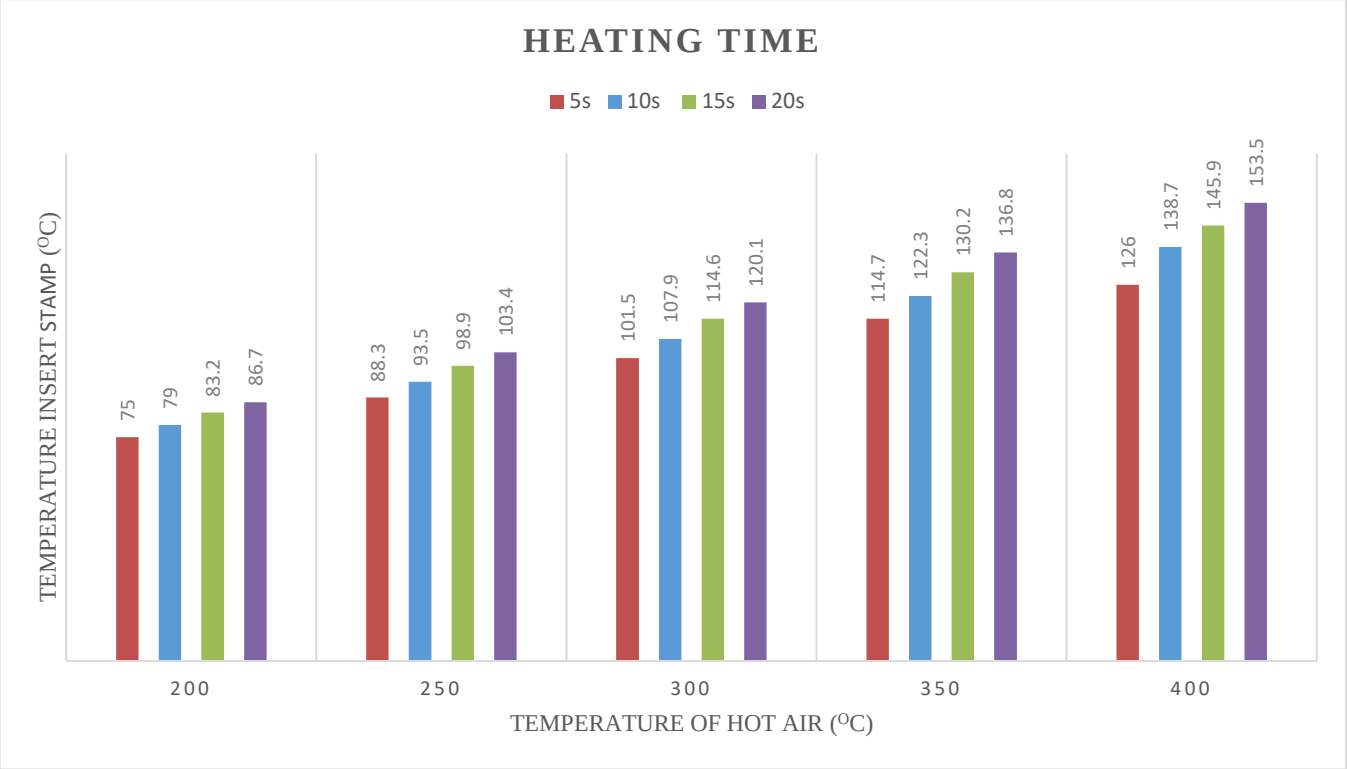

Figure 6: The chart shows the insert plate temperature with *thickness of stamp insert is 0.5mm*

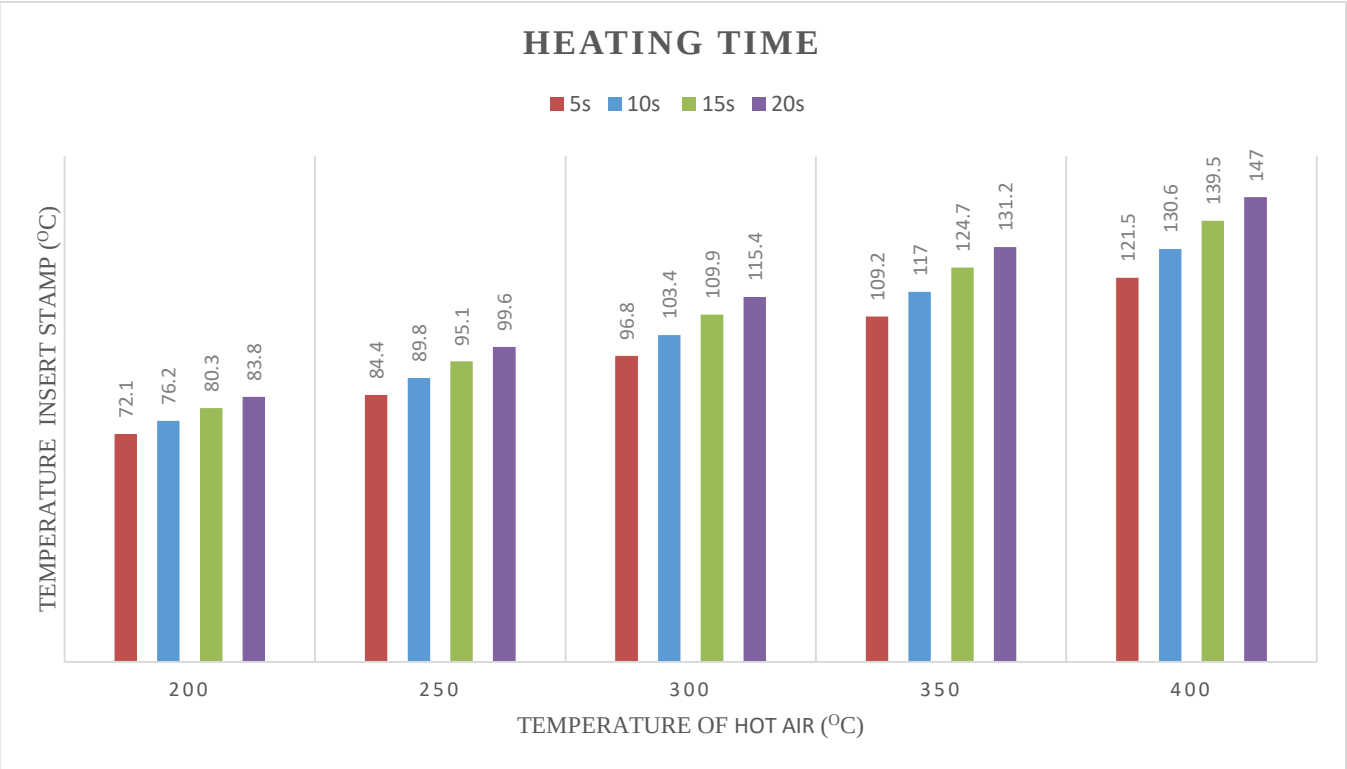

Figure 7: The chart shows the insert plate temperature with *thickness of stamp insert is 0.3mm*

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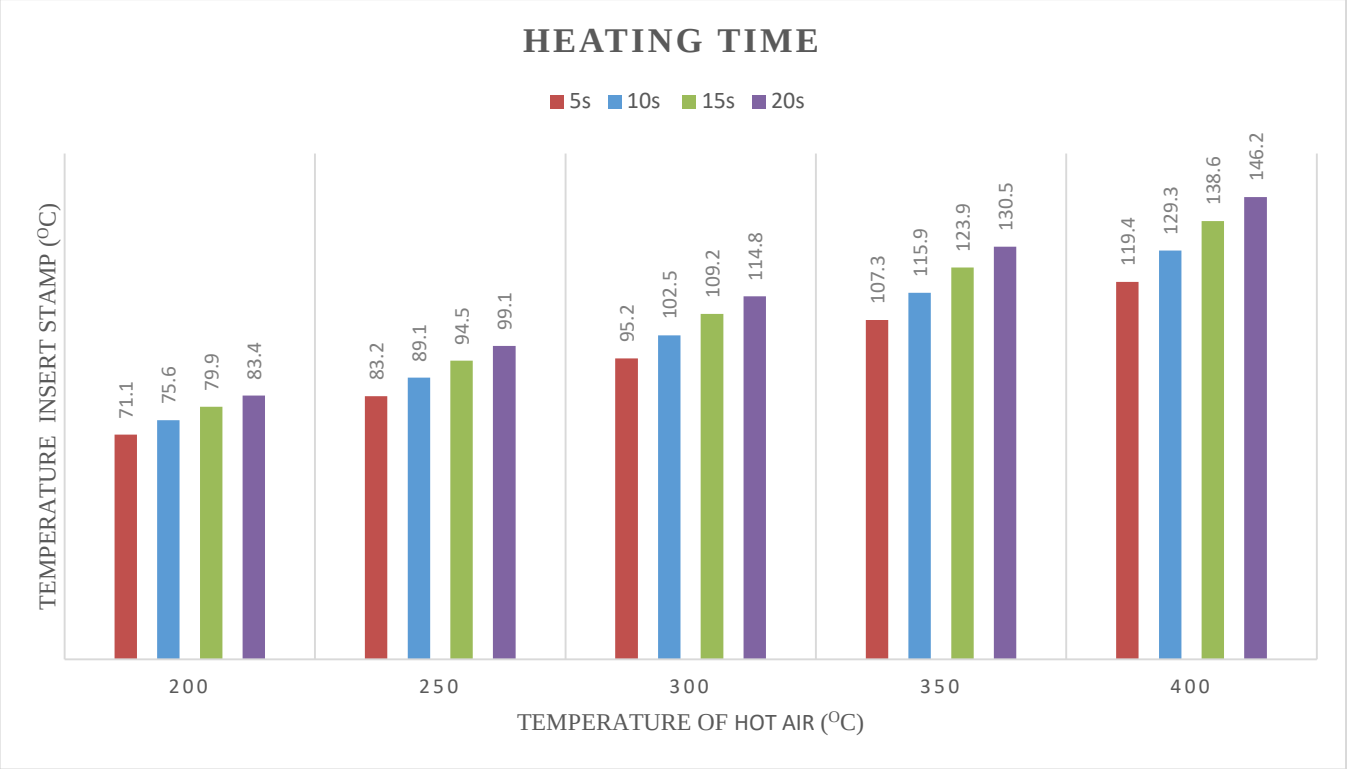

Figure 8: The chart shows the insert plate temperature with *thickness of stamp insert is 0.1mm*

IV. CONCLUSION

- From the above results we see, the greater the hot air temperature and the longer the heating time, the greater the insert plate temperature; during heating at a time of 20 seconds with a heating temperature of 400°C, the highest value is about 153^0C.
- In 3 insert stamp with product thickness of 0.1mm, 0.3mm, 0.5mm, the 0.5mm insert stamp has the highest heating value.

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