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Flash Prevention in HPDC

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Abstract: Welcome to steady die casting solutions. We are at steady die casting solutions keep on continue to give die casting solutions. In this paper we will discuss how we can predict flash location in die and how we can correct before die making or after die making. We also discuss how we can calculate individual tie bar load when we load a die, tie bar load will change on each die changeover because of it's center of gravity. We discuss how casting shot centroid will effect tie bar load which directly responsible for flash. All this things we try to explain with an example, I hope it will be help full. Thank you very much, "keep learning till death".
Keywords: Flash, tie bar, machine tonnage, machine center, die, hpdc, casting defect and clamping force.

I. INTRODUCTION

The die casting die is the heart of the die casting machine. Without the die, all the complex machinery and expertise needed for successful casting is wasted. So this is more important when we design a die we should take care all parameter which are responsible to make good die. For example when we calculate clamping force or machine tonnage required to run this die, we use simply F= P*A, where F is clamping force, P is casting pressure (As per casting application) and A is shot projected area.

This is all we know and yes we also take factor of safety or opening force consideration extra force required to unlock toggle mechanism. But we should know that is what we calculated is total machine tonnage and this will be equally divided in four parts as individual tie bar load.

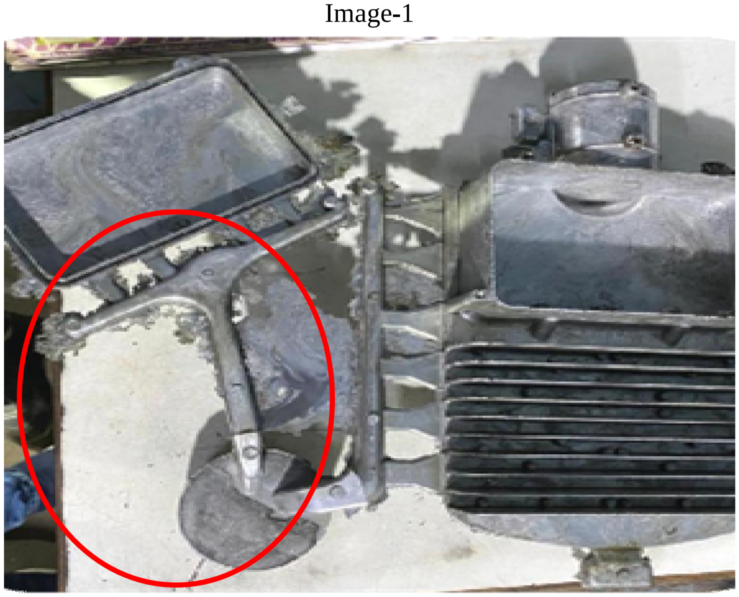
In this paper we are going to discuss, what next after this usual calculation. Once we select machine tonnage and design our complete shot (cavity, runner and spru bush or biscuit), now we have to identify centroid of shot with the help of design software, I am using solid work. Yes, you can easily measure your shot centroid . Put your shot with centroid on selected machine platen or machine center. Now measure each tie bar distance X-axis and Y- axis from shot centroid as we measure in this example.

II. PROBLEM

Die flashing at same place in each cycle, we cant able to make good casting.

What is flashing? Flashing is when metal escapes the mold cavity within the die casting process. The mold cavity includes the runner, biscuit, part, overflow and vent's cavities within the mold. In other words, flashing is when metal goes where it was not designed to go.

Image-1



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A. Why does flashing occur?

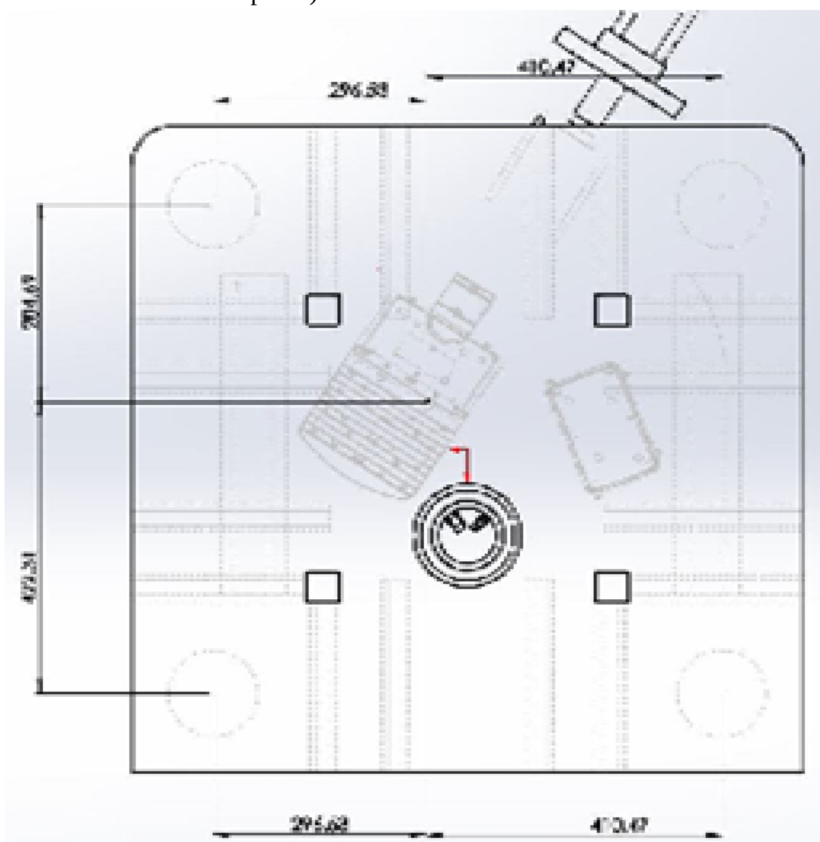
Flashing occurs because of one or more of several problems:

1) The tool seal off around the edge of the cavity is poor.
2) Because the tool and machine do not work together to seal off the mold cavity. The clamping capacity of the machine is too small to withstand the projected area of the casting at the applied metal pressure.
3) Because the impact force at the end of the cavity fill exceeds the clamping capacity of the machine.
4) Flash can also be worsened by an excessively high pouring temperature.

To understand the reason why flashing occurs, we must understand the condition of the machine, the tool, and the forces occurring within the machine at the end of cavity fill.

III. ANALYSIS

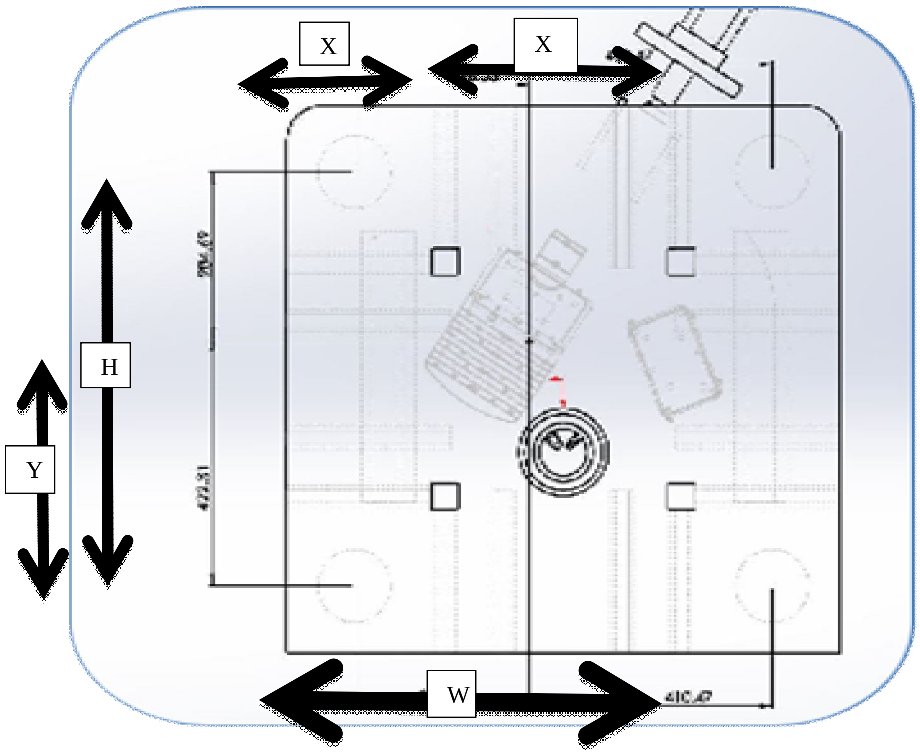
Image- 2(Shot projected area on 350 ton machine plate)



We have formula to calculate individual tie bar load.

Fx= F * (W -X)/ W* (H - Y)/ H

Where,
F= Total machine tonnage.
W= Center distance between two tie bar in X axis.
H= Center distance between two tie bar in Y axis.
X= Tie bar distance from shot centroid in X- axis.
Y= Tie bar distance from shot centroid in Y- axis.
Image- 3



From image -1
F= 350 ton
W= 707 mm
H= 707 mm
X1= 296.53 mm
X2= 410.47 mm
X3= 296.53 mm
X4= 410.47 mm
Y1= 284.69 mm
Y2= 284.69 mm
Y3= 422.31 mm
Y4= 422.31 mm
With the help of above formula we can calculate load on each tie bar, as follows.

F1= 350 * ((707 -296.63) / 707) * ((707 -284.69) / 707)
F1= 350 * (.58 * .59)
F1= 350 * .34
F1= 121.25 ton
F2= 350 * ((707 - 410.47) / 707) * ((707 -284.69) / 707)
F2= 350 * (.41 * .59)
F2= 350 * .24
F2= 85 ton,
F3= 350 * ((707 - 296.53) / 707) * ((707 -422.31) / 707)
F3= 350 * (.58 * .40)
F3= 350 * .23
F3= 81 ton,
F4= 350 * ((707 - 410.47) / 707) * ((707 - 422.31) / 707)

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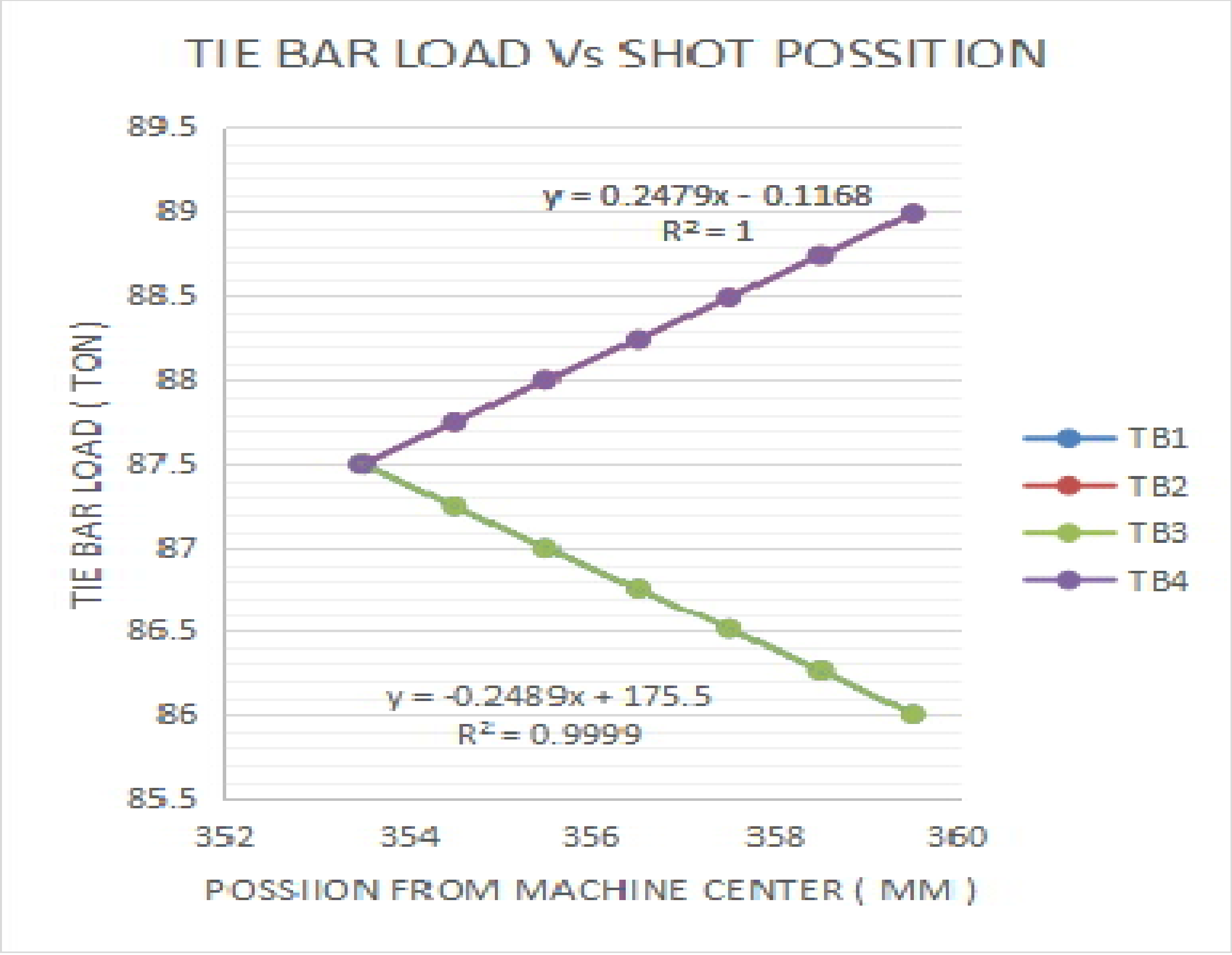
F4= 350 * (.41 * .40)
F4= 350 * .16
F4= 57 ton.
Very good we have calculated individual load on each tie bar. We can see that our
#1 tie bar is over loaded with 121.25 ton instead of 87.5 ton, 38.57% over loaded.
#2 tie bar under loaded with 85 ton, 2.85% under loaded.
#3 tie bar under loaded with 81 ton, 7.42% under loaded.
#4 tie bar very badly under loaded with 57 ton, 34.88% under loaded.
So, we can predict from where flash come out. Our tie bar #4 badly under loaded due to shot centroid. See if you are in designing phase you can correct this problem by changing shot position. Sometimes the off center cavity condition is accommodated with a below center shot position, and the centroid of the shot projected area becomes very nearly on the center of the machine. Then, the size, and cost, of the die are minimized. However, such dies will physically fit into larger machines. And there is often a great temptation to run them in the larger machines for any number of pressing production scheduling reasons. Sometimes the minimum size and cost die is built knowing it will not fit in the center of the machine.
When I am analyzing this problem we already make this tool, so let see what solution we can find out to solve this problem. Good luck.

Image-3



This graph shows the effect on tie bar strain when the shot centroid position moved off center by 1 mm. The left vertical scale is the individual tie bar load in tonnes, and the bottom horizontal scale is distance the shot centroid in mm.

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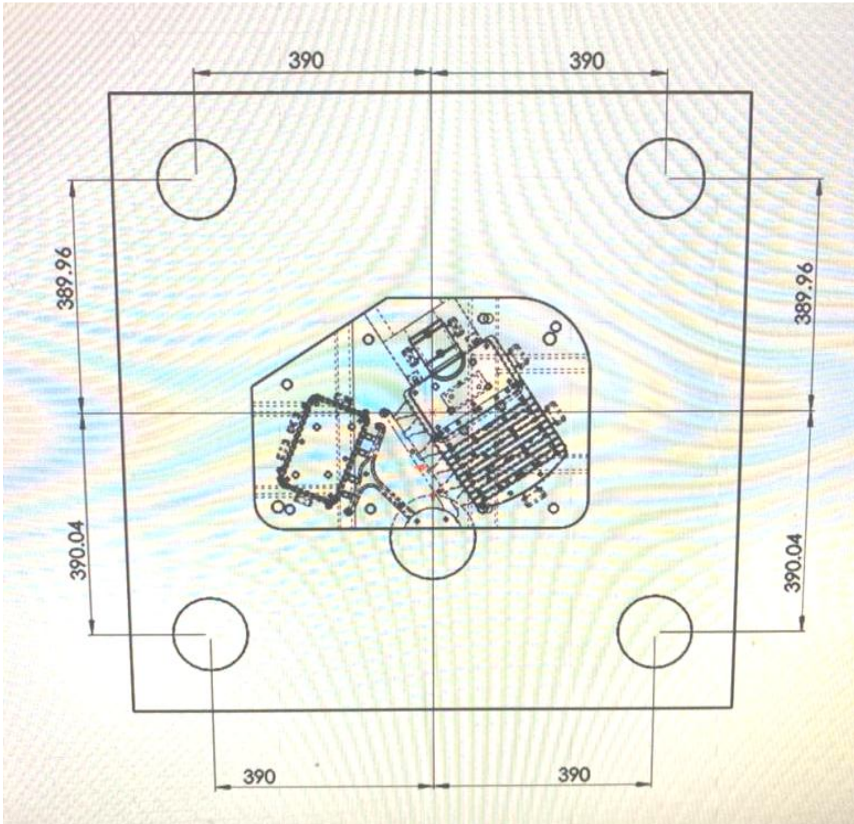
IV. SOLUTION

Above, condition where centroid of the projected area of the cast shot is not on the center of the machine is show in image-1. such a condition requires a larger machine and die and more die clamping force than if the same cavity projected area were to be centered in the machine.

Image-4 (Shot projected area on 550 ton machine plate)



Come on let's do calculation for individual tie bar load with above arrangement. In this example.
F= 550 ton

W= 780 mm
H= 780 mm
X1= 390 mm
X2= 390 mm
X3= 390 mm
X4= 390 mm
Y1= 389.96 mm
Y2= 389.96 mm
Y3= 390.04 mm
Y4= 390.04 mm
Don't forget this formula.
Fx= F * (W -X)/ W* (H - Y)/ H
By using above formula we can calculate load on individual tie bar, so let's do it.
For tie bar #1
F1= 550 * ((780 - 390) / 780) * ((780 - 389.96) / 780)
F1= 550 * (.5 * .5)
F1= 550 * .25

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F1= 137.5 ton
For tie bar #2
F2= 550 * ((780 - 390) / 780) * ((780 - 389.96) / 780)
F2= 550 * (.5 * .5)
F2= 550 * .25
F2= 137.5 ton
For tie bar #3
F3= 550 * ((780 - 390) / 780) * ((780 - 390.04) / 780)
F3= 550 * (.5 * .49)
F3= 137.48 ton
For tie bar #4
F4= 550 * ((780 - 390) / 780) * ((780 - 390.04) / 780)
F4= 550 * (.5 * .49)
F4= 137.48 ton

V. RESULTS AND DISCUSSION

Image-5 Individual tie bar load condition on 350 ton machine

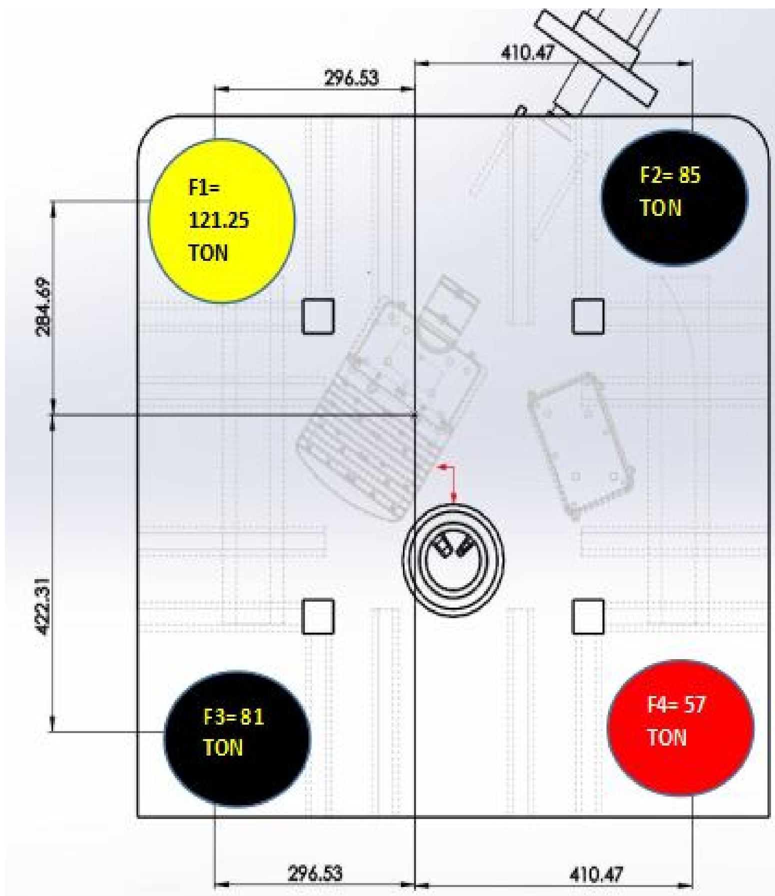

Image-6 Individual tie bar load condition on 550 ton machine

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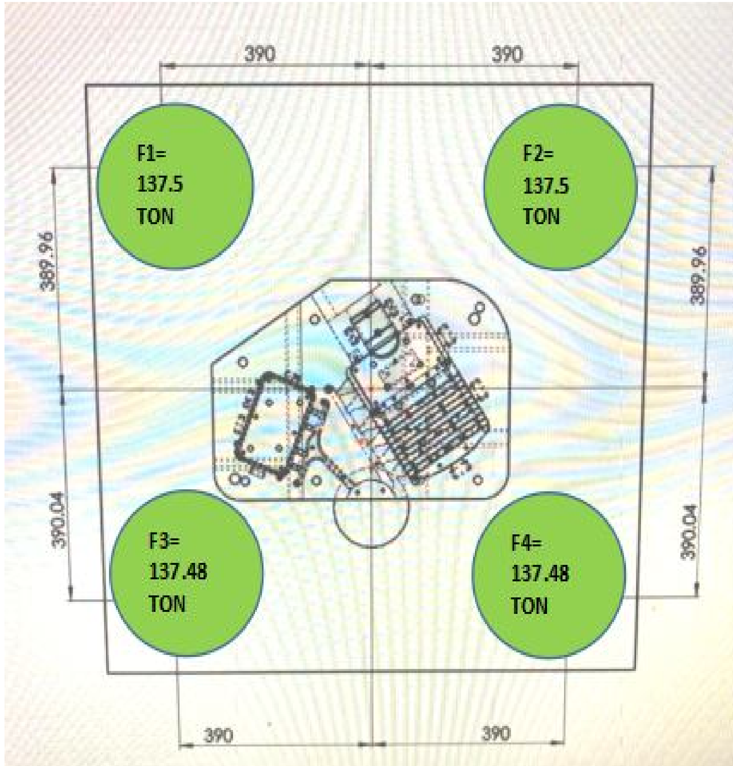

VI. CONCLUSIONS

Reducing flash problem is one of the more frustrating issue for die casting companies and more specially operators, technicians,, and engineers.

There are others factors also we should consider to correct flash problem like,

We should adequately address the die thermal design issue required to minimize flash. Designing die that are thermally balanced around the seal off area of the die will have the greatest effect in the reduction of flashing.

PQ squared mathematical models must be understood well to enable die casting companies to minimize flashing through reduction in accumulator pressure reducing accumulator pressure will not have any negative process consequences as long as fill time and fast shot acceleration are not affected significantly.

Die casters should be fully aware of individual tie bar load calculation with respect to shot centroid So that they can change their shot design before die making and can select suitable tonnage of machine after die making.

In this paper we discussed in detail that how shot centroid affect individual tie bar load. If your shot centroid shift horizontally by 1mm towards any tie bar from machine center it will increase .25 ton load on that individual tie bar. You must take care of individual tie bar load even your all four tie bar load balanced thorough strain gauging. If you already make tool like us so you can accompanist that mistake like above example. As we shift our die from 350 ton plate to 550 ton plate all four tie bar equally loaded which is great result for us.

Through this practical case study we can easily predict from where we will get flash out. I hope this paper will helps to many die casters and prevent many failure's due to unbalance tie bar loading. "I am failure, but I am giving you opportunity to get success". Keep learning till death. Thank you very much.

REFERENCES

[1] F. C. Bennett : Transactions of the 4th SDCE Congress, (1966), No.503
[2] W. Venus : Anschnittechnik für Druckguβ, Gieβerei-Verlag G.m.b.H. (1975),
[3] D. F. Allsop and D. Kennedy: Pressure Diecasting, Part 2, The Technology of the Casting and the Die, (Pergamon Press, Ltd., New York, 1983) p. 6.
[4] T. Kanno: An Introduction to die casting technology, (Nikkan-kogyo sinbunsha, Tokyo, 1997) pp. 227–247.
[5] K. Isobe, H. Noguchi and K. Kato: Tetsu-to-Hagane 77 (1991) 1680– 1687.
[6] S. Ono, K. Minami, T. Ochiai, T. Iwadate and S. Nakata: Trans. Jpn. Soc.

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BIOGRAPHIES

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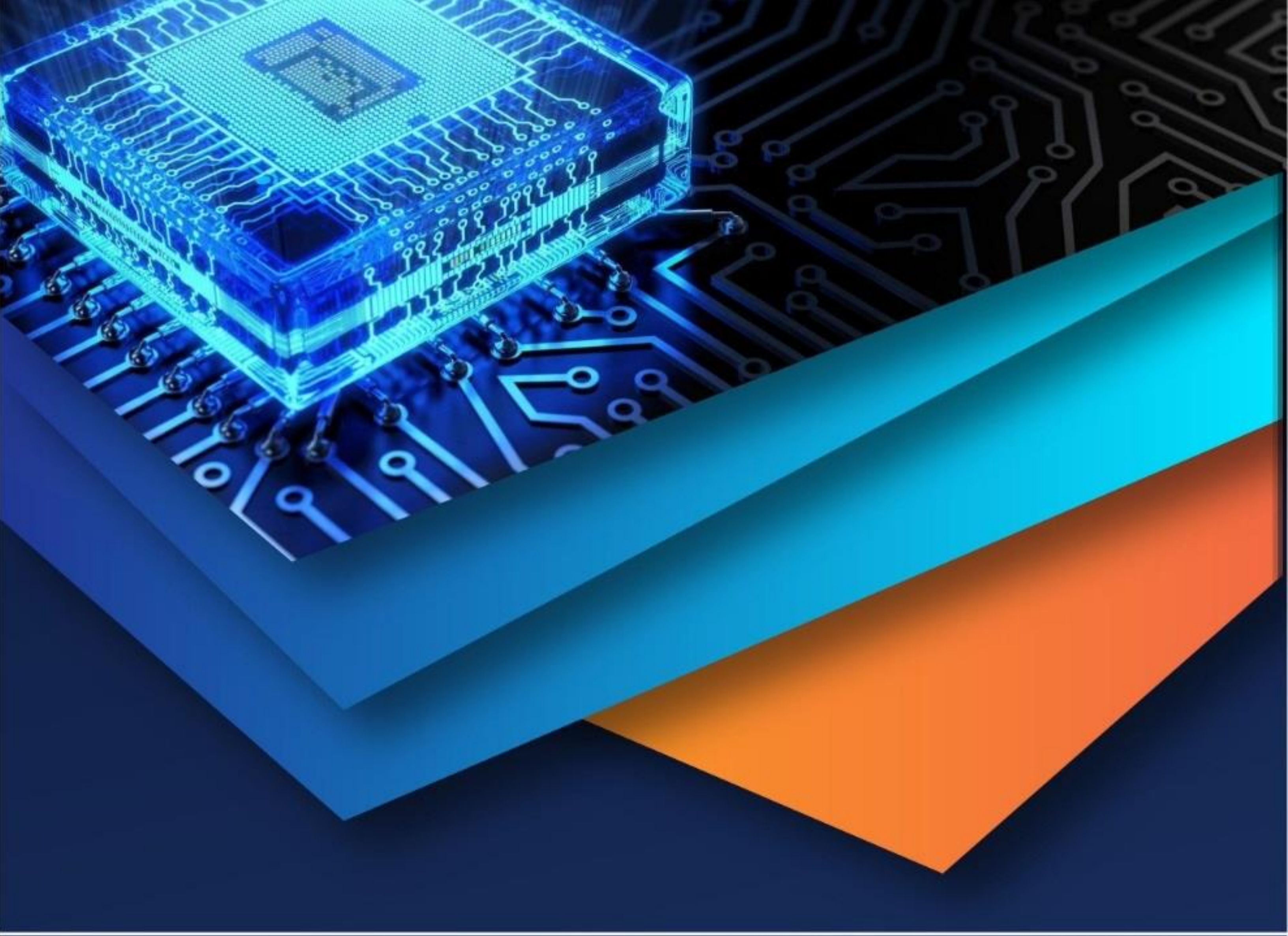

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