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DESIGN OF CORE AND CAVITY INSERT OF PILL BLISTER INJECTION MOLD

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ABSTRACT

Plastic products account for a large proportion of the majority of machinery and equipment, from serving housework, in the family, in the office to cars, airplanes or medical equipment... Therefore, the equipment industry Plastic injection mold design and manufacturing is growing strongly and needs to focus resources to meet the increasing demand for plastic products. Plastic injection molds have the following basic detail clusters: The static mold half includes the static mold cavity, clamping plate, mold cover and expansion pins, screws, plastic channel system and cooling; The movable mold half has an additional product push system. Injection molding plastic products that meet technical requirements requires detailed design work as well as strict technical requirements. This article focuses on the design of static and dynamic mold cavities, which are parts that directly affect the size, geometric shape and surface quality of plastic products.

Keywords: Plastic injection mold, static mold cavity, moving mold cavity, pill blister.

1. INTRODUCTION

Plastic injection molds have hundreds of parts and closely related parts, assembled together to form a mold set that achieves the common purpose of injection molding plastic products. Therefore, designing each detail with size, geometric shape and technical requirements is very important so that these details can perform the task of each detail. For a long time, scientists have applied basic design problems and created machine parts for life or production. Nowadays, with the applications of computer science and modern software technology, the design work is faster and achieves higher design quality. That is the support of CAD and in the article, there is a booh mold design thanks to the support of NX software and there is no shortage of the vitally important contribution of a design engineer with solid background knowledge of plastic injection molds.

Below, the author has briefly described the steps to design mold cavities to press pill blister products with the help of NX. This content helps designers have the skills and general thinking to gradually approach the plastic injection mold design process.
Step 1: Analyze detailed product drawings.
Step 2: Determine the shrinkage factor, and multiply the shrinkage factor
Step 3: Analyze the core and cavity surfaces
Step 4: Determine the origin coordinates of the parting surface.
Step 5: Calculate the size of the mold cavity
Step 6: Design 2 halves of the mold cavity

2. MATERIAL AND METHODS

2.1. Analyze detailed product drawings.

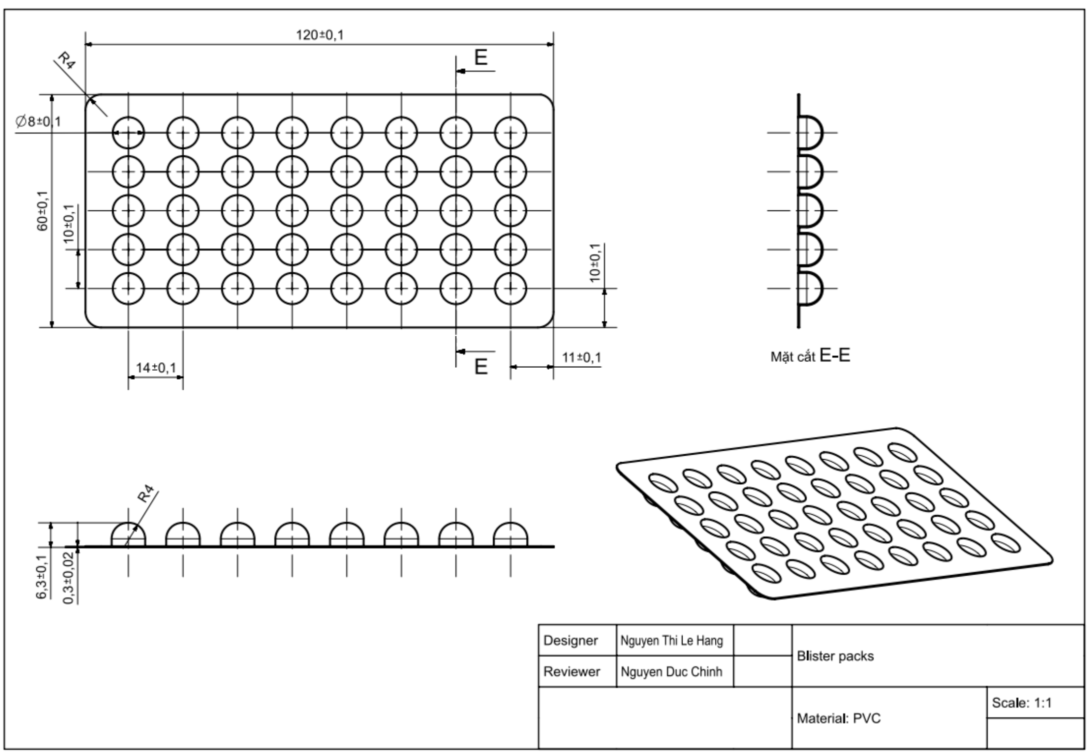


Figure 1. Detailed drawing of pill blister packaging.

2.2. Determine the shrinkage factor, and multiply the shrinkage factor (using the scale body command).

From the results of the medicine blister design, the material is PVC plastic. According to table 1, the shrinkage coefficient of PVC plastic is: 0.002 - 0.003.

Table 1. Shrinkage coefficient.

Material	Shrink Values
Acrylonitrile Butadiene Styrene (ABS)	.004 – .008
ABS/Polycarbonate Blend (PC/ABS)	.004 – .007
Acetal (POM)	.020 – .035
Acrylic (PMMA)	.002 – .010
Ethylene Vinyl Acetate (EVA)	.010 – .030
Ionomer	003 – .020
High-Density Polyethylene (HDPE)	.015 – .030
Low-Density Polyethylene (LDPE)	.015 – .035
Polyamide – Nylon (PA) Filled	.005 – .010
Polyamide – Nylon (PA) Unfilled	.007 – .025
Polybutylene Terephthalate (PBT)	.008 – .010
Polycarbonate (PC)	.005 – .007
Polyester	.006 – .022
Polyetheretherketone (PEEK)	.010 – .020
Polyetherimide (PEI)	.005 – .007
Polyethylene (PE)	.015 – .035
Polyethersulfone (PES)	.002 – .007
Polyphenylene Oxide (PPO)	.005 – .007
Polyphenylene Sulfide (PPS)	.002 – .005
Polyphthalamide (PPA)	.005 – .007
Polypropylene (PP)	.010 – .030
Polystyrene (PS)	.002 – .008
Polysulphone (PSU)	.006 – .008
Polyurethane (PUR)	.010 – .020
Polyvinyl Chloride (PVC)	.002 – .030
Thermoplastic Elastomer (TPE)	005 – .020

On NX software, go to HOME, go to MORE and select scale body (as shown in Figure 2).

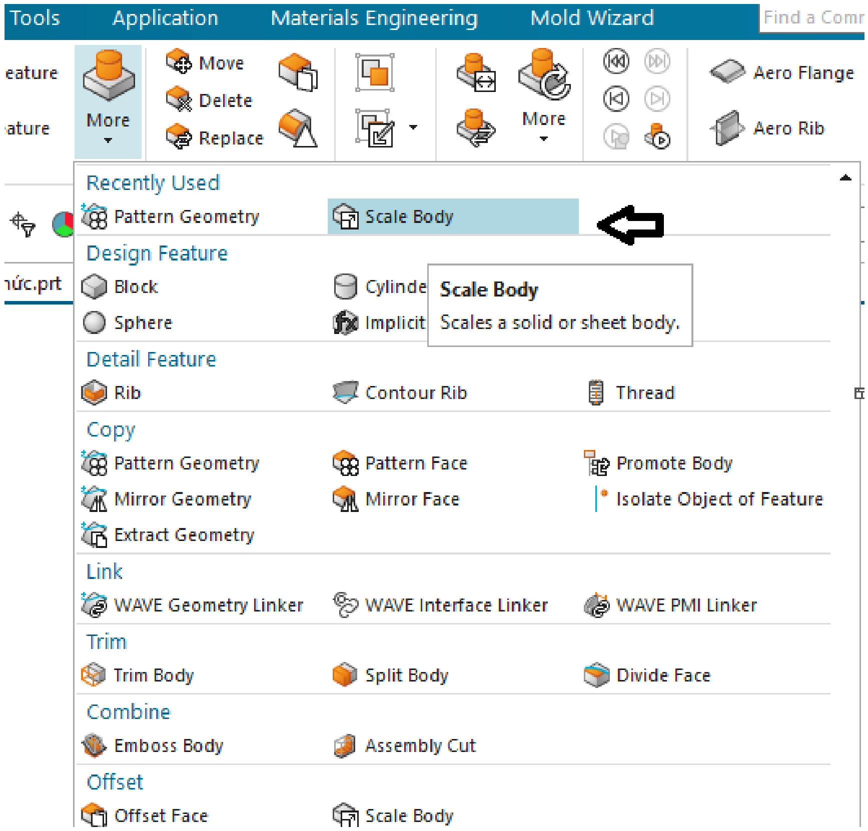


Figure 2. Scale body command.

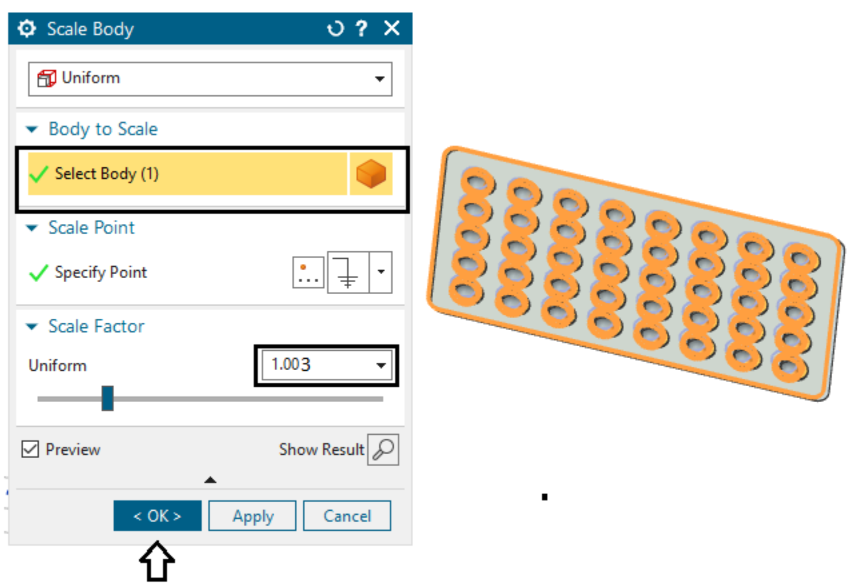
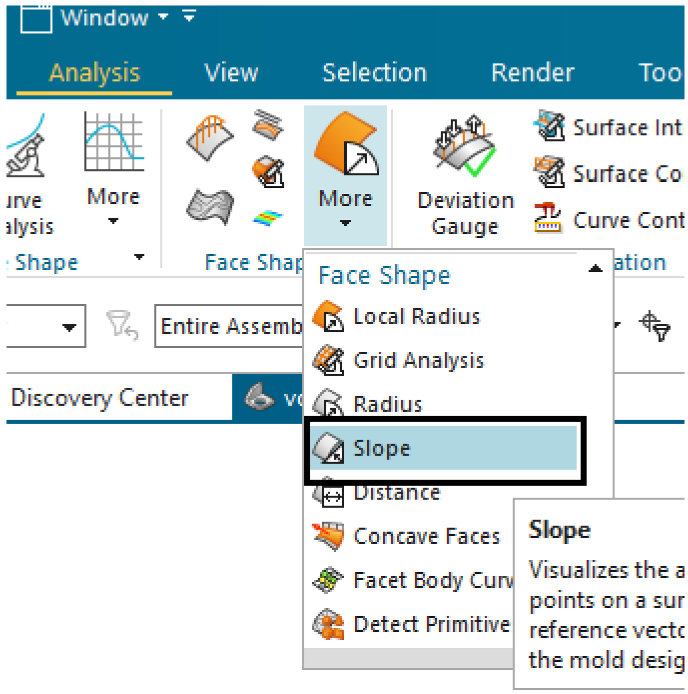


Figure 3: Entering the shrinkage factor.

2.3. Step 3.

Use the SLOPE command. Surface analysis of core and cavity. Any surface that does not belong to the core or cavity must be corrected to have a maximum taper of 2°.

Go to Analysis, go to More and select slope (as shown below).



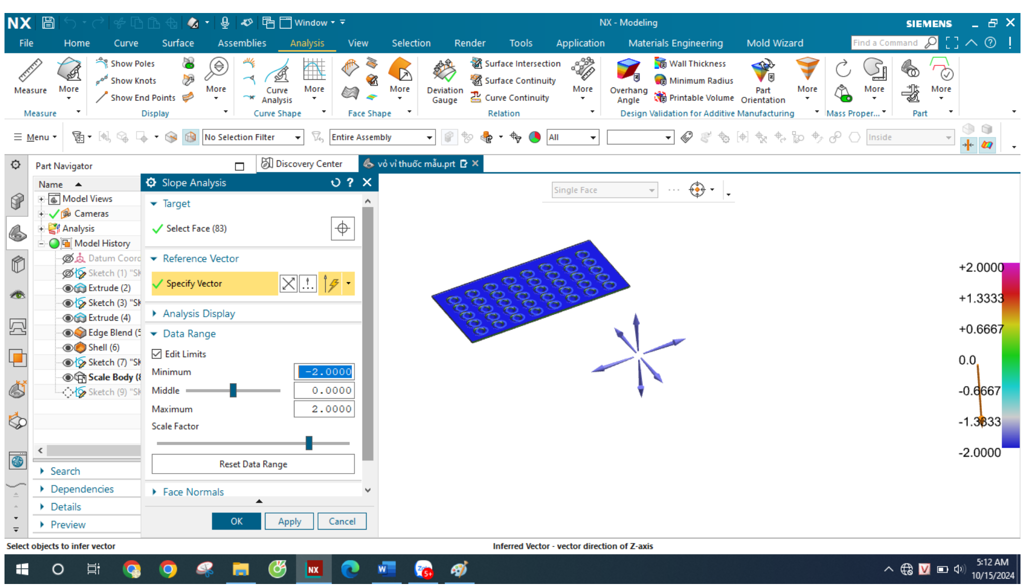


Figure 4. Product surface analysis of two halves of the mold.

We get the result as shown below, having determined that the surface belongs to the core and cavity, we have the intersection between the blue and purple colors which is the parting surface.

2.4. Step 4.

Determine the origin coordinates that lie exactly in the middle of the parting surface.

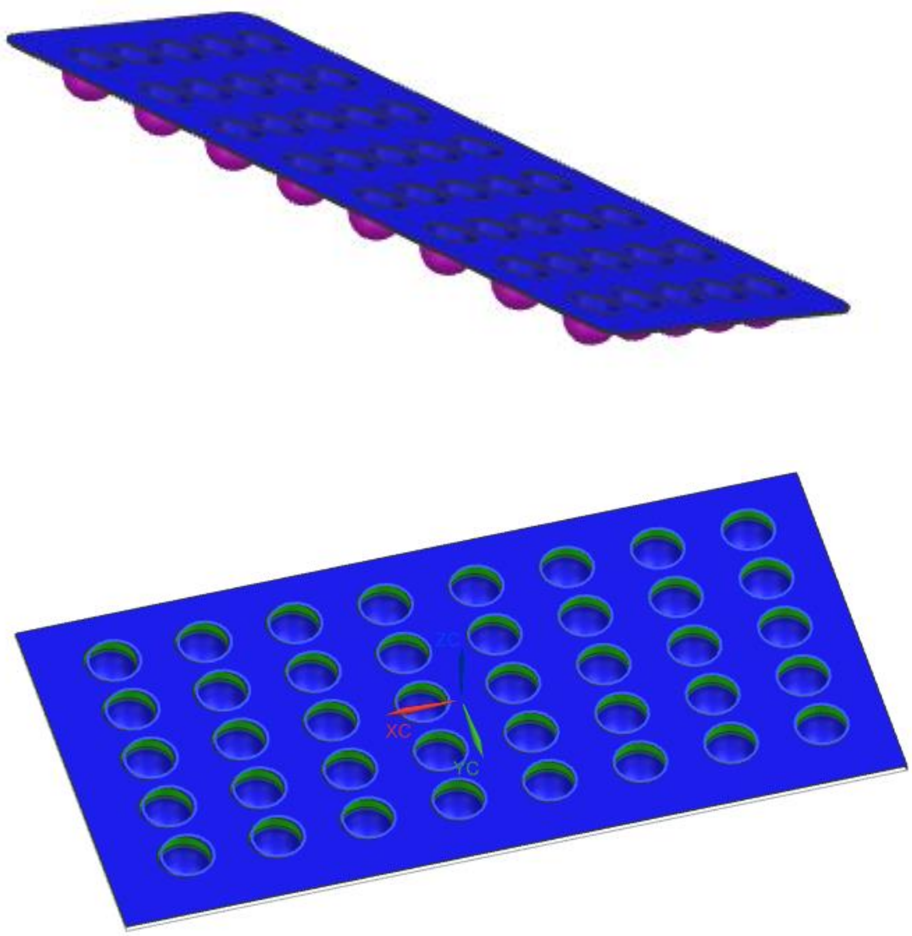
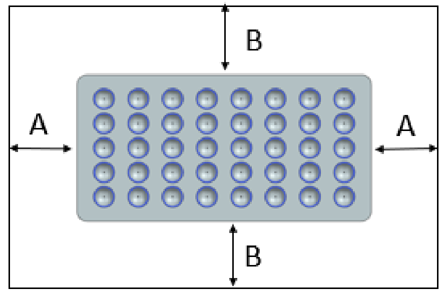


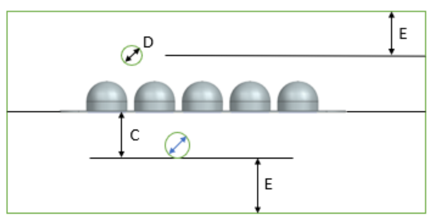
Figure 5. Determine the origin coordinates.

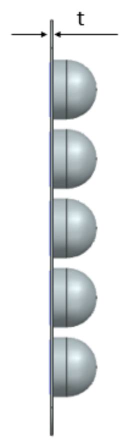
2.5. Step 5: Calculate the size of the mold cavity.



STT	Dimension of part	A	B
1	(< 100 mm)	15-25	15-25
2	(> 150)	30-40	30-40
3	(>400)	50 up	50 up

Dimension of part > 100 → chọn A = 30, B = 30.
Y = 30 + 30 + 120 = 180.
X = 30 + 30 + 60 = 120.





t	D	C	E	mm
<2	8-10	16-30	min10	
<4	12-22	20-36		
<6	22-25	24-26		

Thickness of the part <2 → C = 20, E = 10.
$Z_{\text{trên}} = 6 + 20 + 10 = 36$.
$Z_{\text{dưới}} = 20 + 10 = 3$.

2.6. Step 6: Use the EXTRUDE, SUBTRACT commands to create the mold cavity.

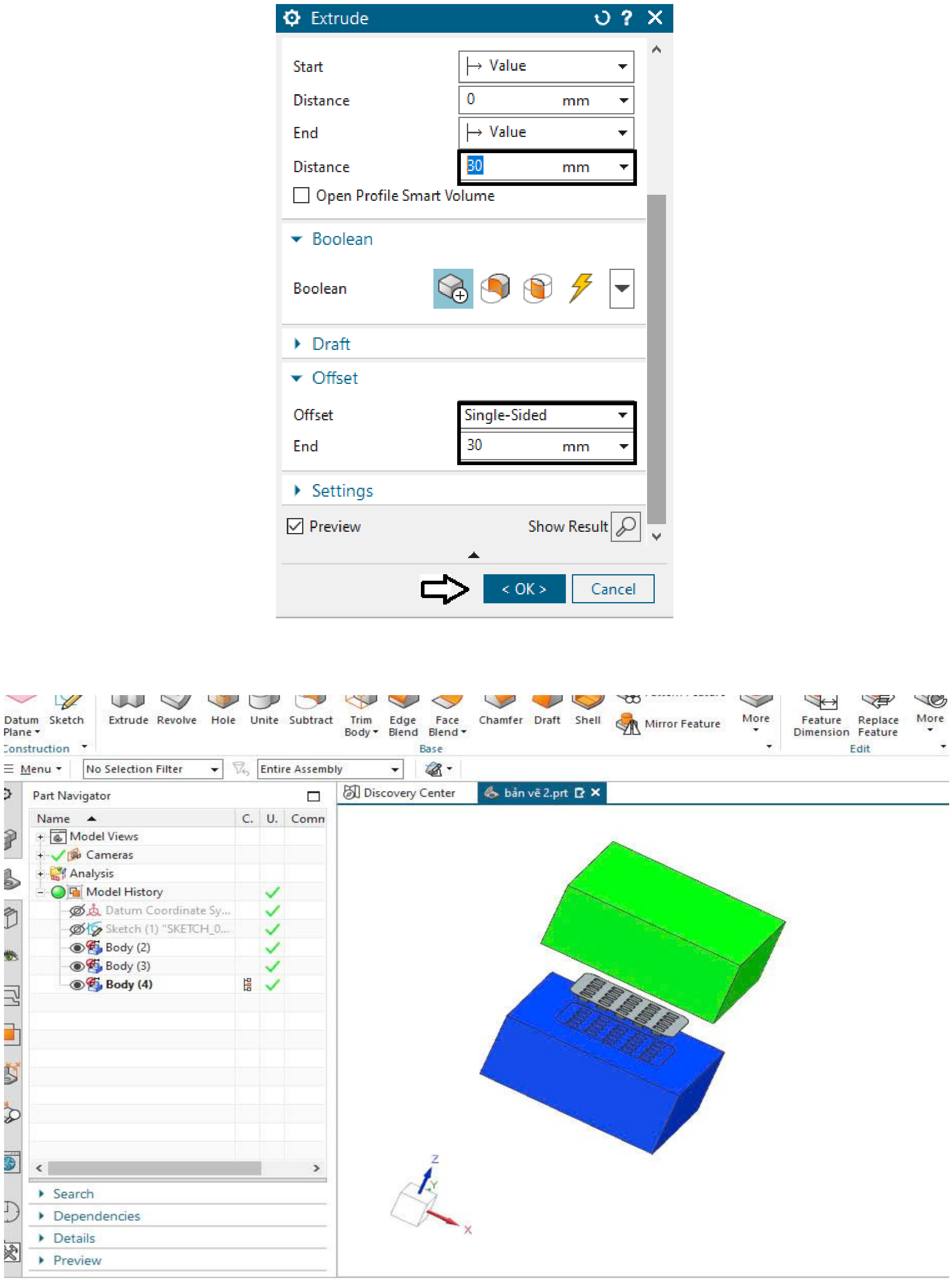


Figure 6. Create the cavity molding.

Due to the small size of the product and high productivity, when designing an injection mold, 4 products can be pressed at once. To create mold cavities for 4 products, press the key combination CTRL + T to create 4 products on the same mold.

3. RESULTS

With the theoretical basis and support of CAD software, the design engineer has preliminary design drawings of the static and dynamic mold cavity, and this data is used as a basis for preparing the design of other parts of the mold such as the shell. Mold and other related details: Clamping plate, ejector system.

Design drawing as below.

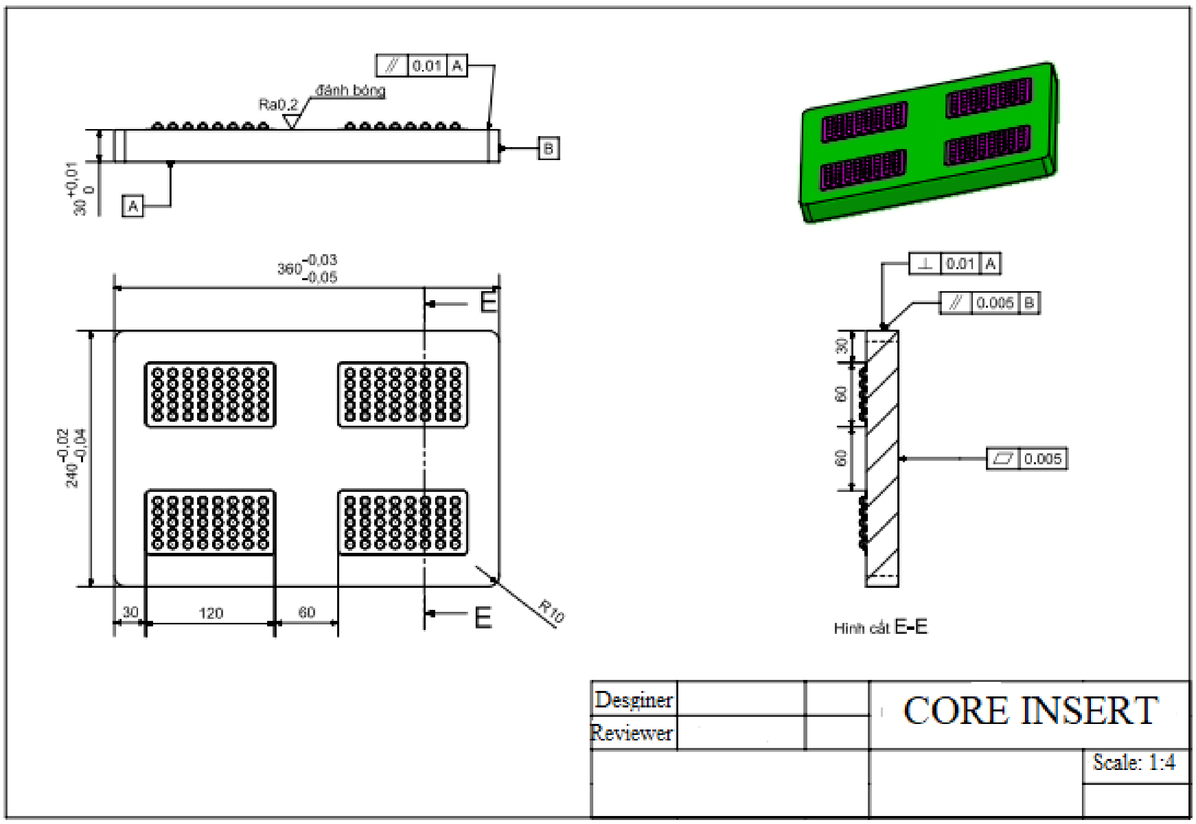


Figure 7. The drawing of core insert.

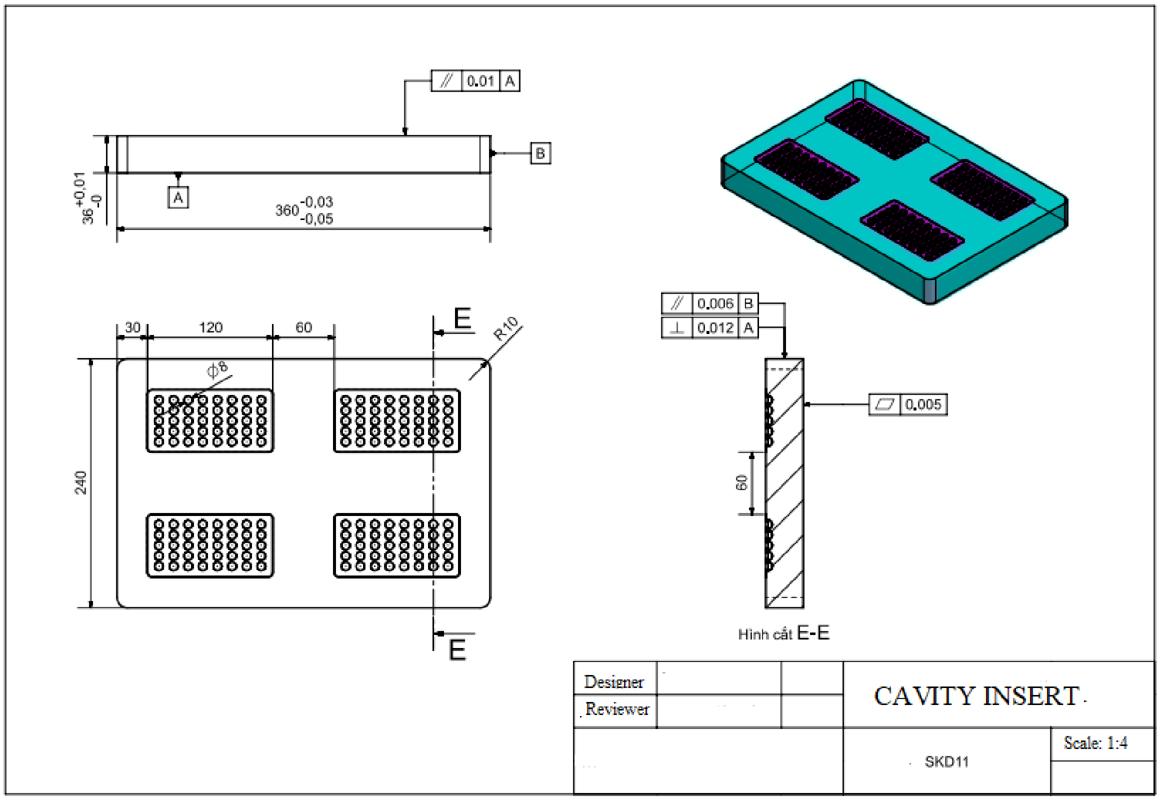


Figure 8. The drawing of cavity insert.

4. CONCLUSION

The article gives the steps to design the two halves of the cavity of a plastic injection mold for a pill blister product. For plastic products similar to this product, engineers can apply this method and have the support of the CAD software that the engineer is using to design the first important part of the plastic injection mold. That helps engineers with a theoretical basis and unified thinking without wasting time studying documents and starting work right away.

However, to design the two halves of the mold, the engineer must also have knowledge of plastic injection molds and have graduated from mechanical engineering or mechanical engineering, which means having basic knowledge of machine detail design.

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