STEM Connections

Injection Moulding

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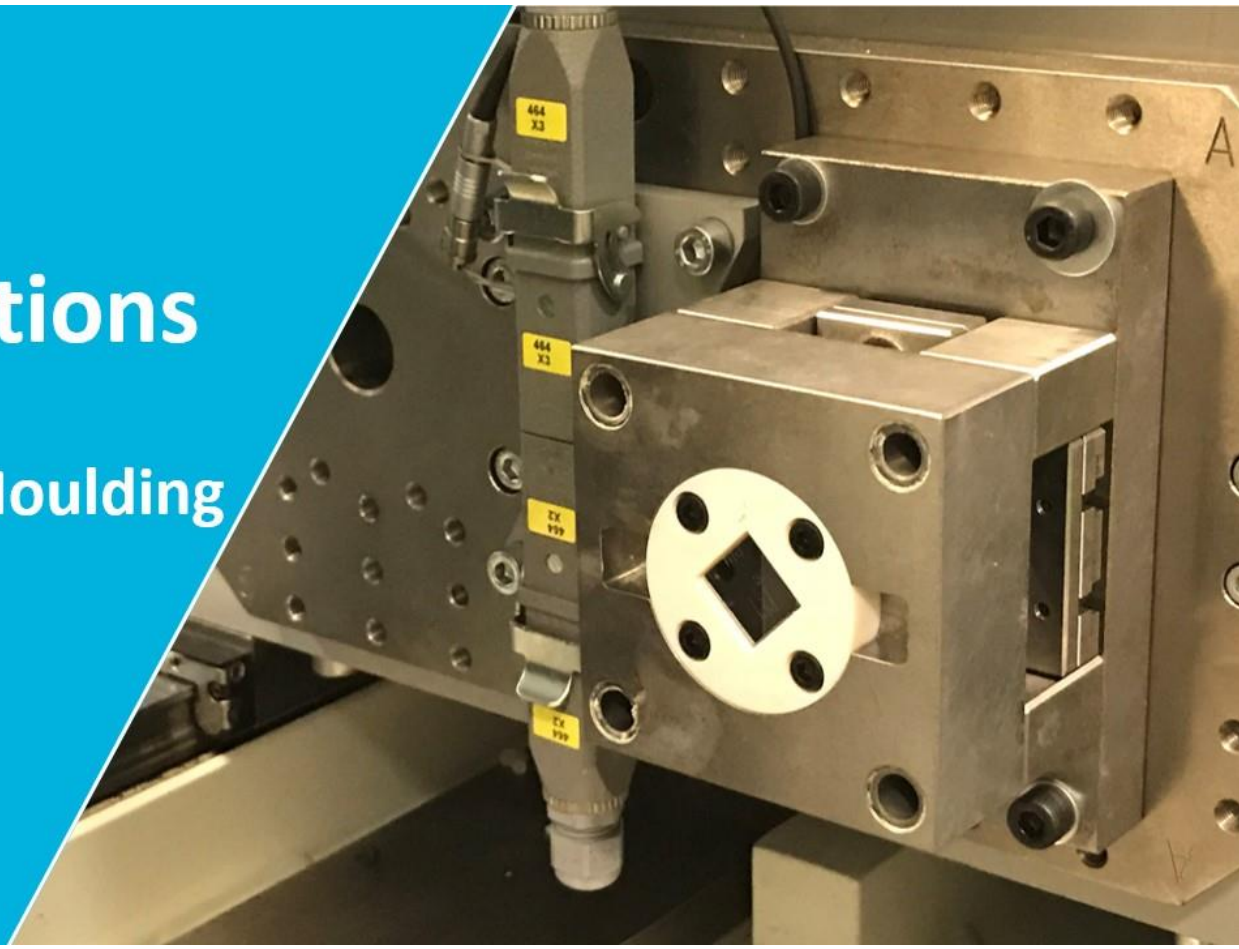


What is Injection Moulding?

We've all used a glue gun to stick our fingers together, what if we moulded it into a shape through a mould? Injection moulding is exactly that. Melt a plastic till its liquid, force it into a steel moulded shape, let it cool and then eject it. Simple and effective, it can be repeated again and again, making thousands of parts quickly. Your mobile phone, TV, food mixer, shower, anything plastic would have been made using this technology because for high numbers of parts it is cheap to make.

However it is expensive to set up, with metal tools costing up to and beyond £100,000, and can take months to prepare depending on complexity – your wheelie bin was injection moulded! The injection moulding machines themselves cost even more.

Innovation, we want it cheaper and faster, what about using 3D printed plastics to mould other plastics? These are cheep to produce relative to metal tooling for moulding and can be completed quicker.

Wait, what? You want to use plastic to mould plastic? Different plastics have different properties, melt temperatures being one of them. You have to pick differing materials to work together, each depending on the application, but once you understand a material and how it works, you can develop techniques towards compatibility. You would not use a chocolate kettle to boil water, it's a waste of good chocolate, but you can boil water in plastic, but not all plastics. Try pouring water onto an empty plastic milk bottle, great for storing milk at low temperatures, but the HDPE Polyethylene has a low melting temperature of 110-130 degrees Celsius, it will deform under the boiling water.

So, we have two different materials, a 3D printer; you can print your design and with a glue gun as a supply of molten plastic, manufacture small volumes, each identical to the las part. Do you have a project for school and want 20 little parts, 3D print the tool and mould with the glue gun. Small volumes which you would never have had before and your experiencing manufacturing towards high volume in industry.

How does this help industry, well previously I developed a product with a company, put a print on in the morning, cleaned the tooling and moulded the parts, reviewed and printed another tool design whilst I had lunch. Product development can now take weeks, or even days compared to months or years with steel tooling. What about research, we only want 50 samples, so can now make 50 samples without the high set up costs, solving one problem provided a route for someone else to improve there own capabilities and the technology is always improving.

How to make your own moulds

Suitable year groups: Year 7, Year 8, Year 9

Learning Objectives:

- To understand how moulds are used in the production of products (KS3)
- To identify methods of improving the manufacturing process (KS3)

Materials required:

- Playdough
- Hot glue gun
- Plastic toy (flat toy for the one-part moulding, and 3D toy for the two-part moulding)

Times estimated: 30 minutes

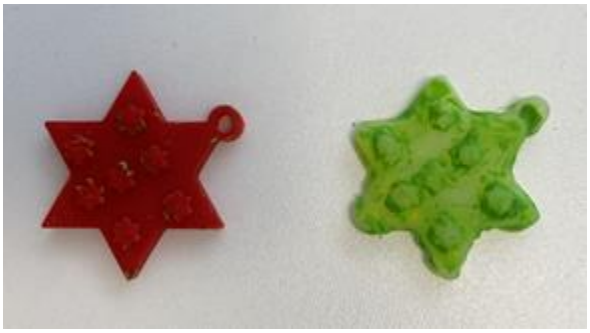
Step by step instructions for one-part moulding:

1. Prepare a playdough and a plastic toy that you like.

2. Press the plastic toy down to the playdough.

3. Carefully remove the plastic toy to form a playdough mould.

4. Use hot glue to fill the mould.



5. Once the hot glue is dried, carefully remove the product out of the mould.

6. Have fun playing with the mouldi! Repeat the processes to produce as much as you like.

Step by step instructions for two-part moulding:

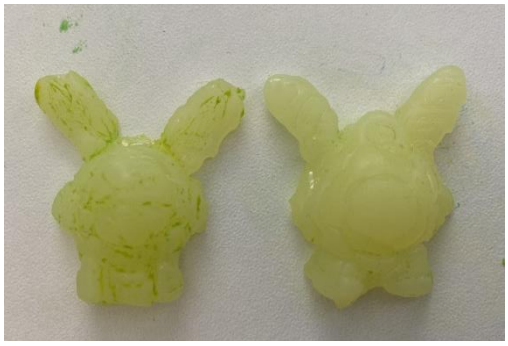
1. Prepare a playdough and a plastic toy that you like.

2. Press half of the plastic toy down to the playdough.

3. Carefully remove the plastic toy to form a playdough mould.

4. Use hot glue to fill the mould.

5. Once the hot glue is dried, carefully remove the product out of the mould.



6. Repeat the process from 2 to 5 for the other half of the plastic toy.

7. Use hot glue to stick two different pieces of the plastic toy.

8. Have fun playing with the mould!

Ideas to explore the concept further

- When using hot glue, why do different layers form? How can you overcome this?
- How could you make a reusable mould that keeps it shape after every use?