Steel Choice

When considering a tool steel for a specific tooling application there are many things that need to be weighed up against each other. The fact of the matter is that the steel choice is an investment that you are making in your production and that an incorrect or uninformed decision will prove very costly in the short to medium term.

When the total cost of the manufacturing process of a tool is analysed, it turns out that the cost of the tool steel itself pales in comparison to the other fixed costs, namely:

- Machining – including grinding and polishing
- Labour
- Downtime – associated to repair/fabrication
- Lost production etc.

During the above analysis it will be found that the cost of the tool steel seldom exceeds 10% of the total costs of the die. This is known as the cost iceberg. The name "iceberg" is a very appropriate name for this analysis, because the majority of the money consuming fixed costs are hidden and once they are discovered, just like the titanic, it is often too late and your production runs-a-ground, with cash flow being sucked out of the business.

How do you prepare for this?

The answer to this question is in fact simple. Understand what the costs associated with the production of a die are, understand that there are hidden costs and take action in order to achieve a competitive edge through longer die life by maximizing the use of your fixed and hidden costs.

By knowing that the cost iceberg is part of the production process of manufacturing a die it can therefore be manipulated. By utilizing the best steel available (for your application) you can maximize the use of the other fixed costs (i.e. labour) by achieving a longer production run which results in a cheaper price per part being produced.

How do you know which tool steel to choose?

In any production process a tool will fail either by cracking/chipping/breaking or by wearing down. Should a tool crack it means that you probably need a tool steel which has more toughness. Should a tool wear, one would probably require a tool with an increased wear resistance. Wear resistance and toughness traditionally work against each other, meaning that the tougher a tool steel is the easier it will wear and vica versa. This means that "traditionally" a balance would be required, and with just the right amount of toughness and wear resistance one would be able to get a good production run.

However “good” production runs are no longer enough to maintain a competitive advantage/edge because the world is striving towards excellence. In a world of excellence, “good” is just not good enough.

So where does this leave me?

Over the passed decade, leaps and bounds have been made with in the metallurgical field. New processes allow you to choose a tool steel that has an increased toughness and wear resistance than the tool that you are currently using. Processes such as Electro Slag Remelting, Vacuum Arc Remelting and Powder Metallurgy have the ability to exponentially increase your production runs ensuring that your entire business runs more economically.

Where do these High Performance Tool Steels get their improved properties from?

The Electro Slag Remelted (ESR) Process:
During this process a conventionally solidified ingot is remelted. A normal ingot that has solidified will have certain “solidification defects” which are minimized through forging operations. There will always be a physical property difference between the centre and the surface of these ingots due to this solidification process. However, if this ingot is remelted the resulting microstructure due to controlled solidification will be different. The surface and the centre of the remelted ingot will now be homogenous (in crystal orientation and physical properties).

It is through this refining of the materials micro structure that it is able to achieve improved chemical properties.

The Vacuum Arc Remelted (VAR) Process:
This process is very similar to the ESR process, where the main difference is that the entire process takes place under a vacuum. Initial melting of the scrap, alloy additions and casting takes place in a Vacuum Induction Melting furnace (VIM). This insures that only the cleanest material will be used to produce Vacuum Arc Remelted Grades.

It is through the refining of the microstructure and the control of atmospheric influence that these grades achieve improved physical properties.

Powder Metallurgical Process:
During this process a molten tool steel grade is processed in order to form a powder. It is important that this powder be uniform in size which is only achieved via Bohler’s 3rd Generation powder producing methods. This powder is then encapsulated and HIP’ed (Hot Isostatic Pressed) where under temperature and pressure the powder diffuses together to form a Powder Metallurgical tool steel with a homogeneous microstructure. Powder Metallurgical tool steel (3rd Generation) is the “best of the best” when it comes to tool steels. It is the tool steel which is able to achieve the longest possible production runs and reduce the price per piece produced.

Naturally these “new” High Performance Tool Steels (as named by Bohler Uddeholm) will be more expensive, however they will actually prove to be more economical due to the increased production life. According to the “Cost Iceberg” this increased initial cost of the tool steel is not likely to exceed 10% of your total die costs. As stated above, the use of High Performance Tool Steels will decrease your price per piece produced making your business more competitive or more profitable, the choice is yours.

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