Environment friendly processes in Automobile Manufacturing

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Abstract: In manufacturing activity, Automobile manufacturing has a major share. Automobile manufacturers are already taking steps to make the manufacturing process environment friendly. ISO 14001 is one step towards this. Recycling/reuse of body panel sheets is one more step which reduces the need for raw material and in turn reduces the impact on natural resources. This paper looks at other avenues in manufacturing with the aim of reducing the need for fresh material and thus save natural resources. With a careful analysis of the activities in metal cutting area a system can be put in place to recycle/reuse used up material and yet derive full benefit at a fraction of the cost of new material. It is possible to lower down the requirement of precious material like Titanium/Tungsten/Aluminium Oxide/Tool Steel by recycling/reuse. A small change in used material for reuse can also give employment to a few people in the community who are made to carry out this change by imparting training so that this activity can be sustained.

Keywords: Recycle, Reuse, Carbide inserts, Grinding wheels, HSS tools.

1. INTRODUCTION

Automobile manufacture involves a large number of machining operations. The manufacturer can plan it in house or out source. Machining operations like Turning, Milling, Drilling, Grinding, Broaching etc. must be performed to convert raw material into a finished part. This paper explains with the help of suitable examples how the overall requirement of the tools can be reduced by a systematic process of recycling. The process of recycle will be possible with complete knowledge of activities being carried out in various shops. This recycle will be much easier for a fully integrated factory where majority of aggregates are made in house. Following are the broad steps involved.

1) Study of used up tools
2) Identify and list down the type which is used in large quantity and is in a usable condition for reuse/recycle.
3) Study of new tools and carrying out ABC analysis w.r.t. expense involved
4) Analyzing if used up tool with a little modification can serve the purpose of a new tool in view of the machining process i.e. roughing/semi finish/finish
5) Ensure that the used up tool is user friendly and does not need expense elsewhere (new holder/new parts).
6) Conduct tests to validate the performance
7) Ensure that quality/productivity is not compromised
8) Get the performance endorsed by the user. Explain cost benefit.
9) Put a system in place such that this activity will be sustained.
10) Monitor and confirm that the benefits are actually reflecting on the spend.
11) Share the learning with other plants / suppliers.

Buying of many costly tools can be avoided by recycling of variety of cutting tools. Be it a used up crankshaft grinding wheel for grinding various other auto parts with a little modification of used up wheel or reusing of used up extra long drills.

It is also possible to carry out a small modification in used up throwaway type carbide inserts and put it back to use for getting 100% output during the reuse at a fraction of the cost of a new tool. A careful analysis of various machining operations will help implement reuse of used up tools without any change because the machining operation permits this reuse. With the first step of looking at what is used it is possible to have a whole lot of ideas for a reuse. Often the used up tool is as good as a new one for some other similar operation taking place in the same plant but another shop or a different plant. Communicating/exchanging ideas after implementation can further lead to reducing the requirement of natural resources.

2. CASE STUDY - 1

Reuse of throw away type inserts by a) direct use, b) with modification.

Direct use: It was noticed from the used up inserts in a milling operation for welding preparation in the manufacture of rear axles that the milling inserts were getting used only on a specific portion of the cutting edge because of the nature of operation as shown below.

- Milling Setup
- Machined component

A large number of milling inserts were getting used in a finish gap milling operation of LCV Stub axles.
where the limited cut during milling was allowing a large portion of the cutting edge remain un used. By simple routing of the used up inserts from stub axle to rear axle we could avoid purchase of almost 3000 inserts per year. We could locate many more operations where such direct reuse was possible.

Use with a modification:
While machining of propeller shaft parts it was found that the suppliers were modifying a standard ISO milling inserts into a special variety by grinding a corner radius. Refer drawings below.

So was the case also with the wiping inserts. Refer drawings below.

We have a large usage of the standard ISO milling inserts in our Die shop. Almost all the requirement of propeller shaft could be met with by modifying the used up milling inserts from the die shop which helped us in avoiding the buying of 9000 inserts in LH and RH variety together with wiping inserts. We found quite a few applications for reusing throwaway inserts by modification.

3. Case Study - 2
Recycling of HSS tools

a) In our stub axle machining, a large number of M42 HSS parallel shank twist drills are being used with a quick change adaptor. These are tailor made step drills for pre tapping operation. See Photographs below.

Looking at the used up drills we found that the shank could be put to use in making a tooth rounding cutter made up from plain HSS for a transmission part. The only change required was the collet size for holding the tooth rounding cutter wherein the earlier collet was of size 12.7 mm and now it is 14 mm.

We could therefore avoid buying of about 400 cutters per year. This tool made from M42 HSS works better than plain HSS.

b) In a transmission part we use broaches to cut a slot for shifting purpose. These broaches had no arrangement for reuse when repeated re grindings made the broach height small. We now reform the broach after the full use by welding a strip at the bottom and restoring the height. This gives us a new broach and reforming cost is less than half of the cost of the new broach.

We recycle around 60 broaches in this manner. In conrod application we recycle a few round broaches by lowering the size to the next lower one.

4. CASE STUDY - 3
Recycling of used up crankshaft grinding wheels

We have many machines engaged in crankshaft grinding. These wheels are about 1000 mm to 1060 mm in diameter and get scrapped when the diameter becomes 725 mm or below.

The number of wheels getting discarded were more than
300 per year. We found that the diameter of discarded wheel is very close to the new wheels being used on other auto components like cam shaft, axle shaft etc and the reuse is possible by modification on the width for direct use or giving a form to make it suitable for angular wheel head grinding operation. We got a few wheels modified and after successful application on cam shaft grinding operation could then implement in other areas.

5. Results

<table>
<thead>
<tr>
<th>Category</th>
<th>Types (Quantity)</th>
<th>Savings Rs Lakhs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throw away type inserts</td>
<td>46(43000)</td>
<td>78.00</td>
</tr>
<tr>
<td>Grinding wheels</td>
<td>6 (111)</td>
<td>4.00</td>
</tr>
<tr>
<td>Broaches</td>
<td>12(104)</td>
<td>5.00</td>
</tr>
<tr>
<td>Other HSS/carbide tools</td>
<td>18(480)</td>
<td>19.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rs 106 L. (-$ 268354 )</td>
</tr>
</tbody>
</table>

6. Conclusion

Recycle/reuse of many industrial tools can be done by careful analysis of the nature of operation. This work can be off loaded to vendors and with training of the people involved in modification of the used up tools it is possible to do so even when this is a precision work. Thus opportunities exist for employment. This activity at Tata Motors Limited has generated an employment for 8 people which is a step towards helping the community. By recycle/reuse our demand for cutting tools has become less which otherwise would have been met with by use of additional natural resources. We therefore have put a system in place for sustaining this reuse. We have shared this information with our plants in other locations and also with suppliers.

7. Scope for further work

a) Recycle of used up long/extra long drills
b) Recycle by changing the hand of the tool (From RH cut to LH cut) for use of unused part of the cutting edge
c) Recycle by cutting a groove to remove the used up portion of a throw away type insert
d) Networking with other plants/suppliers for recycle/reuse

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REFERENCES

[1] Surendra Datar “Practical ideas.” American Machinist. February 2006,