

IMX – Revolutionary exchangeable head end mill system



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Special print

Exchangeable head end mills ■ Automotive industry ■ Milling of castings

»A stroke of luck«

Head and holder made from carbide - this is the secret of how Mitsubishi Materials has enabled the modular iMX end mill system to come close to the performance of solid carbide end mills. Clear evidence that this method is superior to conventional exchangeable head systems is provided by the automotive supplier Beinbauer.

by Michael Hobohm

1 The manufacturing facility at Beinbauer Automotive: 128 machining centres, 60 engine lathes and three bending and hardening machines are used to produce 1800 types of products for the automotive industry
(photo: Hanser)



The end of a vehicle axle to which rotating components such as the hub and brake disc are attached is known as the stub axle. The automotive supplier Beinbauer makes over 100,000 stub axle assemblies per year in many different varieties, and for the past year has been machining some of the parts with exchangeable head end mills from Mitsubishi Materials. Overall Beinbauer supplies four million parts a year for 1,800 types of products delivered to key customers such as MAN, Fendt, ZF, Daimler and John Deere as well as supplying raw materials producers such as Hundhausen and CDP. Thanks to high-precision components and assemblies that Beinbauer have developed

themselves, such as engine sub-frames, steering control arms, axle bridges, planetary carriers, rear axle shafts, track-rod arms, torsion bar springs and anti-roll bars, the company is now one of the leading subcontractors to the commercial vehicle sector and also to the agricultural/construction vehicle, rail, passenger car and motorcycle industries.

As well as the main plant in Büchlberg, where 420 employees work, primarily in the large-scale production of steering knuckles, axle journals and anti roll bars, Beinbauer has also set up facilities in two other locations. One of these is Patraching, and with a staff of 75 was designed as a sub-contract manufacturing facility for ZF with focus on producing bearingless cast-

ings. The other facility based in Oberzell, where they have 65 employees, specialises in a core competence of just-in-time production for MAN. Additionally, one of the company's associates, WMK Maschinenbau R. Wagner in Kelberg, supplies ready-to-install components and assemblies for the vehicle and mechanical engineering sectors. All in all, Beinbauer and Wagner can be regarded as Germany's largest independent manufacturing subcontractors.

Geared-up to meet the requirements of a demanding market

Among Beinbauer's core competencies are the technologies used for making torsion bar springs and anti roll bars, including heat-treatment, hardening and surface

finishing. The company can undertake all the drilling, turning, and milling tasks needed to make precision cast, steel, wrought iron and aluminium parts. The individual products are made in production runs of varying sizes, currently ranging from 50 to several hundred thousand per year. These numbers reflect the strategy of only making parts that can still be produced on conventional machines. On the one hand, this provides the flexibility required to change production to different parts as required but on the other hand, it can also still facilitate large-scale series production. As a result, the stand-alone solutions generally used for the manufacturing process are being increasingly automated. Beinbauer currently operates 128 machining centres, 60 lathes, three broaching machines and three bending and hardening machines for making anti-roll bars. In addition, the company also undertakes a variety of coating and pre-assembly tasks to deliver ready assembled modules to the customer's production line. Above all, Beinbauer is taking great strides toward implementing Industry 4.0 and has recently rolled out machine data logging in all its production facilities.

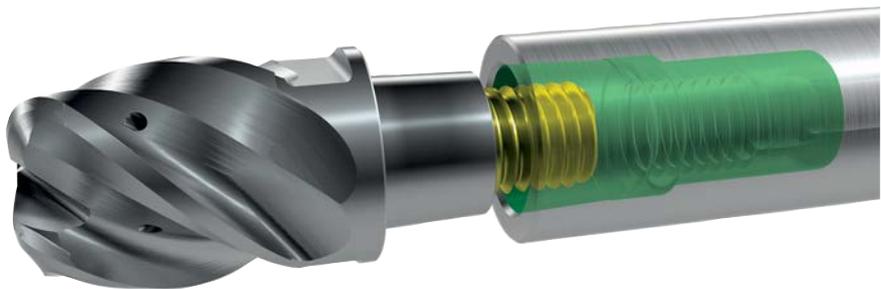
We needed stability, reliability and cost-effectiveness

Since 2011, Beinbauer has been a direct customer of MMC Hartmetall, the European headquarters of Mitsubishi Materials. Even before that, the two companies had been cooperating for years with Franz Kinateder, an MMC area representative responsible for technical support and sales. The co-operation between the two companies currently concentrates on exchangeable and indexable insert end mills, supplied in various geometries for rough and finish machining. Until now, working together on turning applications was prevalent rather than on milling projects. However, this exception, which started a year ago, can be seen as a stroke of good luck.

»We were very dissatisfied with the current manufacturing of axle journals on a Hüller Hille BA600 machine«, says Jürgen Niggel, production scheduler at Beinbauer. »One stage of the process consisted of milling four relieved corners in GGG60 spheroidal graphite cast using only a plunging method. This meant that the end mills had to be especially robust.« The three-flute type that was previously used did not stand up to



2 Anti-roll bars for the commercial vehicle and track vehicle industry are one of Beinbauer's main product lines and account for 14 per cent of the company's turnover (photo: Hanser)



3 The iMX end mill from Mitsubishi Materials, the shank and cutting head are both made of carbide. The stable taper and clamping surfaces give the tools a strength which comes close to that of solid carbide mills (photo: MMC Hartmetall)

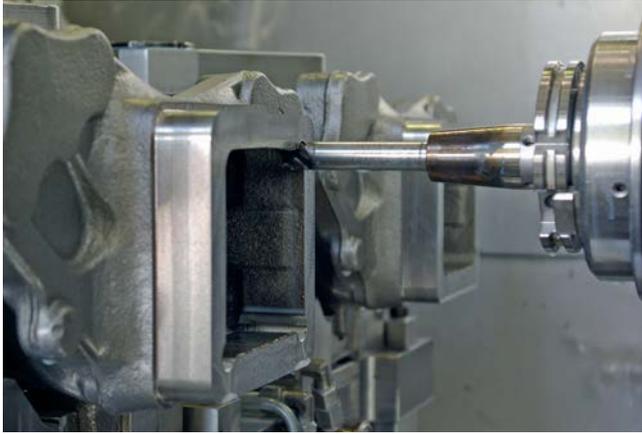
the loads involved: Tool life failed to live up to expectations, cutting parameters were low and the process was not reliable enough. »Fracturing of the tool was a constant problem so we experienced lots of down time and also meant we had to keep buying new tools«, says Martin Veicht of Beinbauer's work scheduling department. The existing three-flute end mills had sintered heads that could not be re-ground, therefore the useful life of each tool was relatively short. Veicht: »And on top of that, the cost of the end mills far exceeded the tool costs per component that we had originally budgeted for.«

»This was the challenge that we then took to MMC, asking them to find a solution«, says Niggel. »And at the same time, we contacted a number of other suppliers too, but the competitors' exchangeable head systems all failed under the heavy loads involved. We also considered using solid carbide tools, but tools of this type, however, cannot cope with the end face plunging

when making axle journals.« There was also another argument against using solid carbide tools: the BA600 operates with a double spindle and must therefore always use two identical tools. »In order to exclude errors from the outset when manufacturing axle journals, we prefer to work with an exchangeable head system, where the clamping device and the tool holder are always of the same length and only the heads are different. This simplifies tool setting considerably«, stresses Veicht. Another main point that had to be clarified before we made any investment was the performance after regrinding and re-coating.

Reliability, long tool life and easy handling were delivered

Beinbauer's choice fell exclusively on the iMX exchangeable head end mill from Mitsubishi Materials that had originally been developed as a four-flute corner radius head for trochoidal milling in the



4 A Hüller Hille BA600 is used to mill two axle journals simultaneously with iMX corner radius end mills. The conditions are difficult because the tool only uses the end face when machining the GGG60. The 16 mm end mill easily masters the task and gives long tool life [photo: Hanser]



5 Franz Kinateder, Martin Veicht, Jürgen Niggel and Wilfried Dydych (from left to right) at Beinbauer's production facility. In the background, an MDE system monitor which have recently been rolled out in the whole production area. (photo: Hanser)

aerospace industry. The very first trials aimed at approaching the previous parameters showed that the tool was extremely smooth running. »So we increased the feed rate from 0.3 to 0.4 mm per revolution«, reports Wilfried Dydych, applications engineer from Mitsubishi Materials, »and found that the tool life was still very good.« The only thing that happened to the end mill under a heavy load were occasional fractures at the centre. »So we modified the centre gash to give the central cutting edge a protective chamfer and then we increased the speed again«, adds Kinateder. »Until then we had not even realised just how tough the new Miracle Sigma coating is.« Today where the depth of the pocket is 58 mm and the width of material to be removed is 9 mm, the 16 mm corner ra-

dius performs at a cutting speed of 126 m/min with a feed rate of 0.04 mm per tooth. These values have allowed the number of workpieces processed per tool to be increased by a staggering 366 per cent and the process has become much more reliable, with a reduction in machining time of 33 per cent.

The corner radius head belongs to the iMX family of end mills where both the head and holder are made of carbide. »Because the contact at the taper and clamping faces of the head are both carbide, the tool has up to 30 per cent better stability than conventional exchangeable head systems and even approaches the rigidity of conventional solid carbide end mills«, says Dydych. »Compared to conventional exchangeable head systems, the screw joint of the iMX can also withstand much higher cutting loads.« The series comprises a wide range of heads including the PVD coated grade EP6120 for machining steel at high feed rates and the uncoated grade ET2020 for milling aluminium alloys. And there is also a new type, EP7020, specially designed for working with difficult-to-cut materials. The heads of the tools used by Beinbauer are made of the carbide grade EP7020 and feature (Al,Cr)N Miracle Sigma coating technology, which gives a much smoother surface and considerably longer tool life than conventional coatings. The heads are available in corner radius, multi-flute, roughing and ball nose types and the holders are supplied in offset shank or conical neck types. The iMX end mill range is suitable

for machining steel and steel alloys through to titanium, cobalt-chrome alloys and Inconel applications.

More than twice as many tools reground than before

Beinbauer's satisfaction with the current process is evident in the number of heads in use. From the very onset, it became commonplace to regrind and recoat the end mills. MMC is constantly expanding its regrinding service through its extensive network of partners and today about 30 per cent of all carbide tools sold are reground. For Beinbauer for example, two tools are always ground to the same dimensions so that there are always two identical tools available. »Whereas carbide tools can usually be reground about five times, in this case the iMX could be reground up to twelve times«, claims Veicht, »This really is a stroke of luck for us.«

Changing over to the iMX exchangeable head end mills has not only brought Beinbauer considerable improvements in tool life, reliability and handling, but has enabled the company to keep tool costs down to the level originally planned. »The manufacturing process for the axle journals simply could not be better«, says Veicht in summary. »It works a treat and we are very pleased.« ■

INFORMATION & SERVICE



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