FHI and RIKEN
Jointly Developed New Processing Technology for Automobile Components

Fuji Heavy Industries Ltd. (FHI) and RIKEN jointly developed the ELID* Honing Process, a new method of finishing the bore portion of automobile engine cylinders, based on RIKEN's ELID grinding method. Some models in the Subaru Legacy passenger car series launched in the Japanese market on May 24, 2006, are already equipped with engines incorporating volume production components processed using the ELID Honing Process.

The bore portion of automobile engine cylinders supports the reciprocating motion of the piston, which influences such engine performance parameters as output and fuel efficiency. Highly accurate finishing is essential in achieving higher performance, and honing is available as a conventional method for such processing. Honing comprises rotating and reciprocating a cylindrical tool equipped with a number of rod-like hones while pouring a grinding fluid to increase the accuracy of finishing the bore surface. As such, honing requires a high level of skill, expensive equipment, and long processing time, posing a major problem with engine production costs.

FHI developed the ELID honing process in cooperation with RIKEN and employed the new process in the volume production of its horizontally opposed engines. This is the world's first commercial application of RIKEN's ELID grinding method to the volume production of automobile engine components.

The ELID grinding method is a mirror-finishing technology developed by Dr. Hitoshi Ohmori, chief scientist at RIKEN. Grinding takes place by means of hones in which diamond abrasives are set using iron or the like as a binder. During the processing, the binder is electrolyzed to constantly expose the diamond particles to the hone surface for the sake of what is called "hone dressing." Thus, reductions in grinding performance
due to clogging, etc., are avoided, and processing accuracy is stabilized. Another advantage is the extended service life of the hone, which reduces losses related to such miscellaneous operations as cutter exchanges.

To date, the ELID grinding method has been used as a sophisticated technology, offering both high quality and high work efficiency in the mirror processing of materials that are hard and, hence, difficult to process, such as silicon, glass, ceramics, extremely hard steel materials, and composite materials. Conventional applications include semiconductor substrates; electronic/optical components, such as lenses, magnetic heads, hard-disk substrates, and optical connectors; and the production of metal molds.

By introducing the ELID honing process, FHI succeeded in shortening the actual processing time per cylinder required to finish the bore portion of a cylinder, from 70-80 seconds to approximately 40 seconds, and improved the accuracy and stabilization of the bore face.

Because this new process can be introduced only with minor alterations to existing equipment, including the addition of electrodes, equipment investments can be reduced and equipment shutdown minimized. Another advantage is the ability to cope with likely growth in demand in the future without installing additional equipment because throughput will increase with a shortened processing time.

Furthermore, the employment of this process enables reductions in power consumption thanks to the shortened processing time together with the use of water-soluble grinding fluid of an excellent feature for low environmental loads.

Although this process has been introduced to only a few production lines, the expansion of the coverage of subject components is likely in view of its high versatility. FHI will consider its application to more components to achieve further quality improvement and cost reductions.

*ELID is the acronym for electrolytic in-process dressing.*

For further information, please refer to the following Web sites:

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