# ALNEX (ANX Series)—High-Efficiency Cutter for Aluminum Alloys

## 1. Outline

Recently, automobile-related industries are required to protect the global environment by improving the fuel economy of vehicles. To meet the requirement, vehicle manufacturers are increasing the use of aluminum alloy and other nonferrous metal parts to reduce vehicle weight, in parallel with an increase in the production of hybrid vehicles, electric vehicles, and fuel cell vehicles. To increase the productivity of these nonferrous metal parts by improving machining efficiency, cutting tools are required to be easy to handle and feature highly effective chip evacuation, thereby reducing machining time and non-machining time. In light of the situation, demand for lighter-weight cutting tools suitable for compact machining equipment is also increasing recently to improve the productivity per unit area of machining equipment. To meet such demand, Sumitomo Electric Industries, Ltd. has developed a polycrystalline sintered diamond (PCD) cutter, ALNEX (ANX series) (Photo 1), for high-efficiency aluminum alloy machining application.

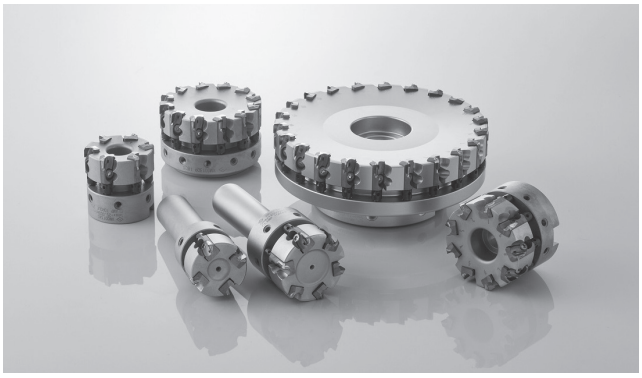


Photo 1. ALNEX (ANX series)

## 2. Features of ALNEX (ANX series)

### 2-1 Achieves high-speed/high-efficiency machining

A newly devised technique for clamping a blade having a cutting edge to the ALNEX (ANX series) body enables such a multi-blade cutter design as 4.5 blades per inch. In particular, 18 blades can be clamped to a 100-mm diameter cutter. The new cutter is designed so that it minimizes the effect of centrifugal force on the displacement of the blade edges when the cutter is rotated at high speed. Therefore, the ALNEX (ANX series) can ensure stable, high-accuracy machining even under a high-efficiency machining condition of 30,000 mm/min or more, as shown in Fig. 1.

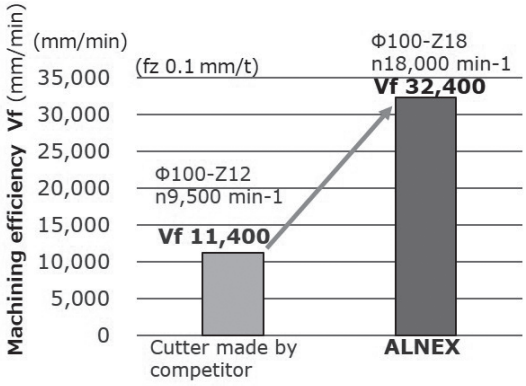



Fig. 1. Machining efficiency

### 2-2 Easy to handle

For a cutter provided with a conventional wedge-type blade run-out adjusting mechanism, the cutter body is deformed when it is clamped to the blade edge with a wedge. Since this method changes the blade edge height, it is necessary to repetitively adjust the run-out of the blade.

Another shortcoming of a conventional cutter is that it extends the tool replacement cycle and blade run-out

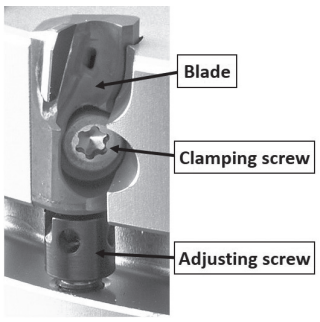



Fig. 2. Clamp and blade edge adjusting mechanism

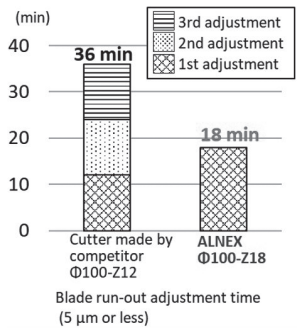



Fig. 3. Blade run-out adjustment time

adjustment cycle as the number of blades clamped to the cutter body increases. Further, a small pocket in the cutter tends to make the cutter difficult to handle. In contrast, the ALNEX (ANX series) comprises a simple clamping mechanism that minimize deformation of the blade body when clamping it to the cutter. The blade run-out adjusting mechanism allows fine run-out adjustment as shown in Fig. 2. As a result, blade edge height can be adjusted by a single cycle of blade run-out adjustment as shown in Fig. 3. In this manner, the new blade run-out adjusting mechanism significantly reduces the adjustment time and makes the new cutter easier to handle.

**2-3 Useful for compact machining equipment**

Two types of ALNEX (ANX series) body are available: a steel body and a lightweight aluminum body. Since a 100-mm diameter aluminum body cutter weighs only 1.0 kg or less, it can be used for such compact machining equipment as BT30.

**2-4 Highly effective chip disposal**

A newly developed carbide forming technology is used to make the ALNEX (ANX series) cutter. This technology allows the coolant supplied into the cutter body to pass through the blades as shown in Photo 2, and flow out from points near the blade edges. Since the coolant can maintain high pressure until it reaches the blade edges, chips are divided into smaller pieces as shown in Photo 3. The above function prevents chips from winding around the workpieces, thereby making it easy to remove chips from the workpieces.

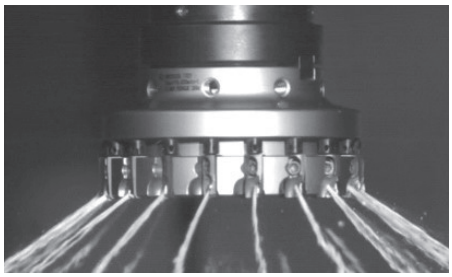


Photo 2. Coolant discharged from points near blade edges

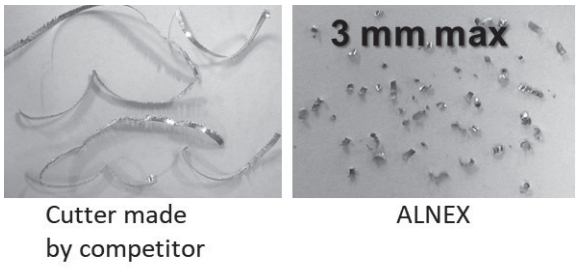
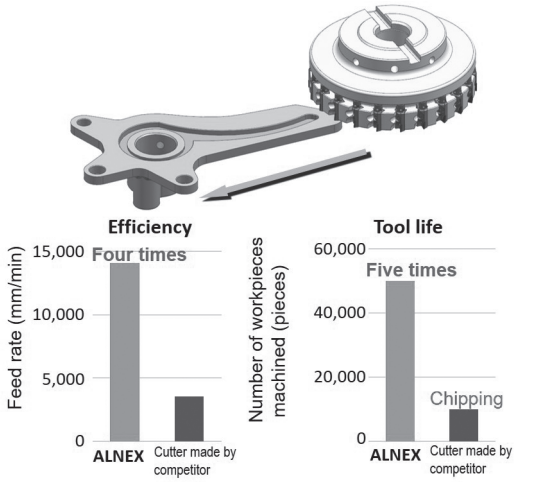



Photo 3. Comparison of chip size

## 3. Example of Machining

Figure 4 shows an example of machining an aluminum alloy automotive part. The total weight of a 125-mm diameter aluminum body ALNEX (ANX series) plus arbor is only 1.75 kg. Since this weight is less than half that of a conventional steel body cutter, the new cutter has become useful for the BT30 machining equipment that is used for the experimental machining shown in Fig. 4. In addition, since the 125-mm diameter ALNEX (ANX series) is a multi-edge cutter consisting of as many as 22 blades, its machining efficiency is four times higher than the cutter made by a competitor. The blade edges of the ALNEX (ANX series) are made of SUMIDIA DA1000, Sumitomo Electric Industries, Ltd.'s original polycrystalline diamond material that is tough and superior in wear resistance. The blades of the cutter made by a competitor have a breakage at the cutting edge during the machining, while the ALNEX (ANX series) maintains stable machining without any chipping. It has achieved a tool life five times longer than that of the competitive cutter. As described above, the ALNEX (ANX series) significantly increases the productivity of aluminum alloy automotive parts and reduces their production cost.




Equipment used for experimental machining: vertical M/C BT30
Material used: ADC 12 for automotive parts
Cutting tool used: ANXA 16125R22 (φ125, 22 blades, aluminum alloy body, *total weight including that of arbor: 1.75 kg)
Insert: ANB1600R-G (DA1000)
Cutting condition: $V_c$ = 3.142 mm/min, $V_f$ = 6.432 mm/min, $a_p$ = 0.5 mm, wet

Fig. 4. Example of machining