FUTA-Q Imagination & Innovation

Technical Information

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Achieved L/D 80!
Challenging the limit of deep small hole drilling of Φ0.5 mm

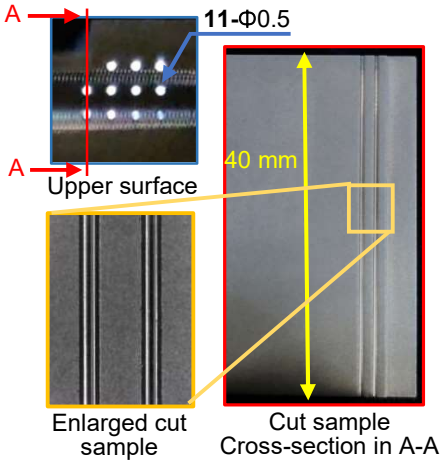
1. Challenges in machining extremely small-diameter holes

Making flow channels in a component used to precisely control gases and liquids requires high-precision hole making that takes into consideration not only the diameter, length, and shape, but also the surface condition of the inner surface. We introduce a case study that challenges the limits of “small-diameter deep hole drilling” which can be utilized in machining processes for variety of parts.

2. Example of drilling small-diameter deep holes

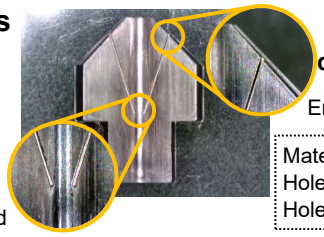
Our deepest record in machining a small-diameter hole of Φ0.5 mm was about 13.5 mm. By optimizing the machining tool and parameters, however, we have succeeded in machining a deep hole with a depth of 40 mm, L/D (aspect ratio) of 80. Deep holes made with a drill have the feature that their inner surface can be finished smoothly.

【Machining method】	【Results】
Through-hole by drilling	Inner surface roughness
Material: SUS304	Ra: 0.16 μm
Hole diameter: Φ0.5 mm	Rz: 1.12 μm
Hole depth: 40 mm	Linearity: ±0.08 mm



3. Example of drilling precision small-diameter holes

In order to drill a small-diameter hole of Φ0.2 mm at an accurate position, machining tools and parameters must be optimized. With our technique, the tip of a small-diameter hole can be aligned even if drilled from an oblique work surface.



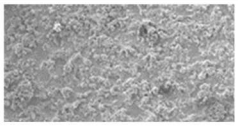
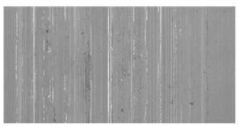
Cut sample of diagonal drilling

Enlarged

Material: Ti-6AL-4V
Hole dia.: Φ0.2 mm
Hole depth: 5.0 mm

4. Difference in surface conditions by processing

The surface condition of a product often significantly affects the performance in the way as the dimensional accuracy does. The table below illustrates the differences in surface conditions depending on the machining methods on a flat surface. A surface condition can be adjusted by selecting machining method, machining parameters, and finishing treatment.

Processed examples of SUS304		wire-EDM	Machining	Surface grinding
Surface roughness	Ra (μm)	3.1	3.8	0.1
	Rz (μm)	20.6	16.5	1.7
SEM images	x 250			

FUTA-Q Co., Ltd.

URL https://futaku.co.jp E-mail futaku-info@futaku.co.jp

[Headquarters]
33-3 Karahashi-keiden-cho, Minami-ku, Kyoto City, Kyoto Pref. 601-8454
Tel: +81-75-661-2931

[Tokyo Office]
Mitaka-myojo-palace 3F,
1-1-3,Kamirenjaku Mitaka-shi,
Tokyo 181-0012,Japan
Tel: +81-422-27-7629