

EPSBE

Super-Hard Ball Nose End Mills for Maximum Tool Life

FEATURES

Double face (two-stage flank) prevents radius from deteriorating while machining

Extremely accurate radius tolerance: +0.003mm to -0.007mm

Wide variety of neck length variations

Long tool life is possible even when machining materials with a hardness of greater than 60 HRC



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INTRODUCTION

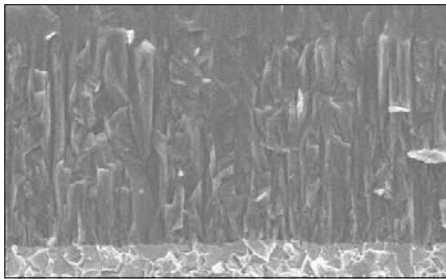
Hitachi Tool's new EPSBE Super Hard Ball Nose End Mills feature our newly developed ATH Coating to enable high-efficient machining of high-hardness materials. This new coating, coupled with the highly rigid tool geometry, provide exceptionally long tool life and excellent cost performance.

FEATURES

1. Advanced TH (ATH) Coating

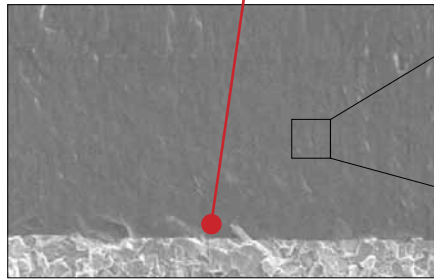
With a hardness of 3800Hv and oxidation temperature of 1200°, our new ATH Coating enables longer life and higher efficiency when cutting high-hardness materials (55HRC or higher). Compared with our previous generation coating, double the tool life and more than double the machining efficiency can be achieved. The ATH Coating is ideal for both dry cutting and wet cutting in a variety of materials including cold-worked die steel, HSS, tool steel, composite materials, carbide alloys and more.

Cross-section electron microscope photograph

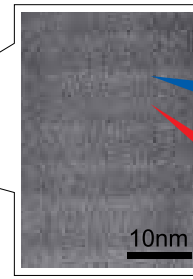


Conventional TH Coating

Adhesion is markedly improved to provide more stable machining.



New TH Coating for hard material



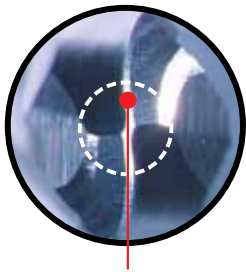
High hardness membrane

High heat resistance membrane

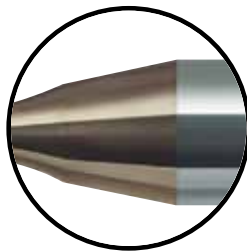
10nm

Even finer particle size is nano order. Provides high heat resistance and high hardness.

2. Unique Tool Geometry for Maximum Performance



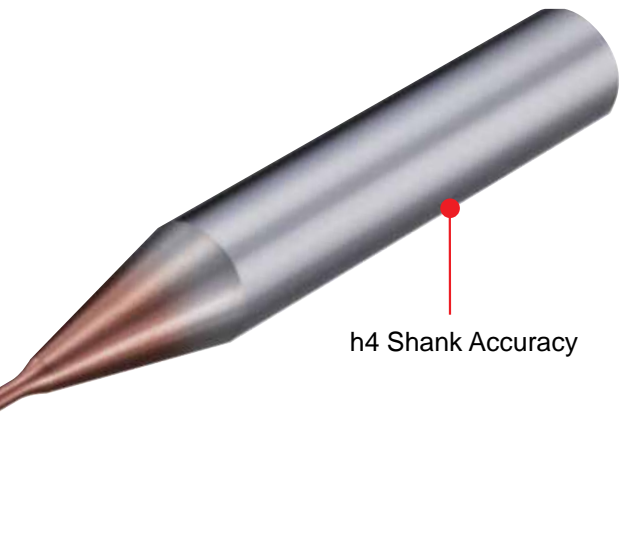
Double-face effect prevents shape from deteriorating



Reliable combined neck shape

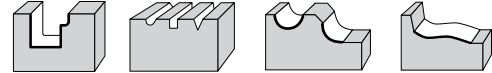
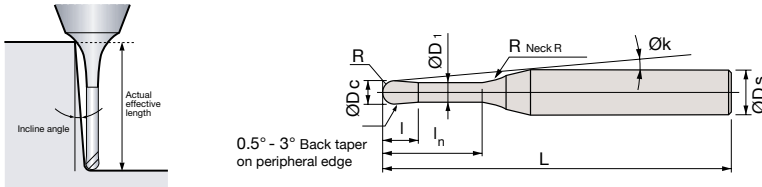


Reliable backdraft shape



h4 Shank Accuracy

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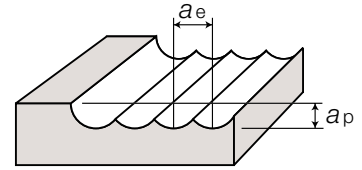


| | | | |
|-------------|----------------|---|----|
| Helix Angle | 30° | d | h4 |
| R | +0.003, -0.007 | | |

| Part No. | Size (mm) | | | | | | | Neck R | Øk | Actual Effective Length in Incline Angles | | | | |
|-------------------|-----------|----------------|------|----------------|----------------|----|----------------|--------|-------|---|-------|-------|-------|-------|
| | R | D _c | I | D ₁ | L ₂ | L | D _s | | | 0.5° | 1° | 1.5° | 2° | 3° |
| EPSBE2001-0.15-TH | 0.05 | 0.1 | 0.08 | 0.08 | 0.15 | 45 | 4 | 1 | 11.82 | 0.30 | 0.32 | 0.33 | 0.35 | 0.38 |
| EPSBE2001-0.3-TH | 0.05 | 0.1 | 0.08 | 0.08 | 0.30 | 45 | 4 | 1 | 11.64 | 0.46 | 0.48 | 0.50 | 0.52 | 0.57 |
| EPSBE2002-0.3-TH | 0.10 | 0.2 | 0.15 | 0.17 | 0.30 | 45 | 4 | 1 | 11.66 | 0.49 | 0.50 | 0.52 | 0.54 | 0.58 |
| EPSBE2002-0.6-TH | 0.10 | 0.2 | 0.15 | 0.17 | 0.60 | 45 | 4 | 1 | 11.30 | 0.80 | 0.83 | 0.86 | 0.88 | 0.93 |
| EPSBE2003-0.45-TH | 0.15 | 0.3 | 0.25 | 0.27 | 0.45 | 45 | 4 | 2 | 11.53 | 0.73 | 0.77 | 0.80 | 0.84 | 0.91 |
| EPSBE2003-0.9-TH | 0.15 | 0.3 | 0.25 | 0.27 | 0.90 | 45 | 4 | 2 | 11.00 | 1.21 | 1.27 | 1.32 | 1.37 | 1.47 |
| EPSBE2003-1.5-TH | 0.15 | 0.3 | 0.25 | 0.27 | 1.50 | 45 | 4 | 2 | 10.36 | 1.84 | 1.92 | 1.99 | 2.06 | 2.18 |
| EPSBE2003-2-TH | 0.15 | 0.3 | 0.25 | 0.27 | 2.00 | 45 | 4 | 2 | 9.88 | 2.36 | 2.46 | 2.55 | 2.62 | 2.76 |
| EPSBE2004-0.6-TH | 0.20 | 0.4 | 0.30 | 0.37 | 0.60 | 45 | 4 | 2 | 11.39 | 0.88 | 0.93 | 0.97 | 1.01 | 1.09 |
| EPSBE2004-1.2-TH | 0.20 | 0.4 | 0.30 | 0.37 | 1.20 | 45 | 4 | 2 | 10.69 | 1.52 | 1.59 | 1.65 | 1.71 | 1.82 |
| EPSBE2004-2-TH | 0.20 | 0.4 | 0.30 | 0.37 | 2.00 | 45 | 4 | 2 | 9.88 | 2.36 | 2.46 | 2.54 | 2.62 | 2.75 |
| EPSBE2004-3-TH | 0.20 | 0.4 | 0.30 | 0.37 | 3.00 | 45 | 4 | 2 | 9.03 | 3.41 | 3.53 | 3.63 | 3.73 | 4.01 |
| EPSBE2005-0.75-TH | 0.25 | 0.5 | 0.35 | 0.47 | 0.75 | 45 | 4 | 2 | 11.25 | 1.04 | 1.09 | 1.13 | 1.18 | 1.27 |
| EPSBE2005-1.5-TH | 0.25 | 0.5 | 0.35 | 0.47 | 1.50 | 45 | 4 | 2 | 10.39 | 1.83 | 1.91 | 1.98 | 2.05 | 2.17 |
| EPSBE2005-3-TH | 0.25 | 0.5 | 0.35 | 0.47 | 3.00 | 45 | 4 | 2 | 9.00 | 3.41 | 3.53 | 3.63 | 3.72 | 3.99 |
| EPSBE2005-5-TH | 0.25 | 0.5 | 0.35 | 0.47 | 5.00 | 45 | 4 | 2 | 7.64 | 5.48 | 5.65 | 5.78 | 6.01 | 6.65 |
| EPSBE2006-0.9-TH | 0.30 | 0.6 | 0.40 | 0.57 | 0.90 | 45 | 4 | 4 | 11.10 | 1.33 | 1.42 | 1.51 | 1.59 | 1.75 |
| EPSBE2006-1.8-TH | 0.30 | 0.6 | 0.40 | 0.57 | 1.80 | 45 | 4 | 4 | 10.08 | 2.30 | 2.44 | 2.56 | 2.68 | 2.88 |
| EPSBE2006-3-TH | 0.30 | 0.6 | 0.40 | 0.57 | 3.00 | 45 | 4 | 4 | 8.98 | 3.58 | 3.77 | 3.93 | 4.07 | 4.32 |
| EPSBE2006-5-TH | 0.30 | 0.6 | 0.40 | 0.57 | 5.00 | 45 | 4 | 4 | 7.59 | 5.70 | 5.94 | 6.14 | 6.32 | 6.63 |
| EPSBE2008-1.2-TH | 0.40 | 0.8 | 0.50 | 0.77 | 1.20 | 45 | 4 | 4 | 10.79 | 1.65 | 1.75 | 1.84 | 1.93 | 2.11 |
| EPSBE2008-2.4-TH | 0.40 | 0.8 | 0.50 | 0.77 | 2.40 | 45 | 4 | 4 | 9.47 | 2.94 | 3.10 | 3.24 | 3.36 | 3.59 |
| EPSBE2010-1.5-TH | 0.50 | 1.0 | 0.80 | 0.96 | 1.50 | 45 | 6 | 4 | 11.01 | 2.01 | 2.12 | 2.21 | 2.31 | 2.49 |
| EPSBE2010-3-TH | 0.50 | 1.0 | 0.80 | 0.96 | 3.00 | 45 | 6 | 4 | 9.88 | 3.61 | 3.78 | 3.93 | 4.06 | 4.30 |
| EPSBE2010-4-TH | 0.50 | 1.0 | 0.80 | 0.96 | 4.00 | 45 | 6 | 4 | 9.25 | 4.66 | 4.87 | 5.00 | 5.20 | 5.47 |
| EPSBE2010-6-TH | 0.50 | 1.0 | 0.80 | 0.96 | 6.00 | 45 | 6 | 4 | 8.20 | 6.76 | 7.02 | 7.23 | 7.42 | 7.92 |
| EPSBE2010-8-TH | 0.50 | 1.0 | 0.80 | 0.96 | 8.00 | 45 | 6 | 4 | 7.36 | 8.85 | 9.15 | 9.40 | 9.61 | 10.58 |
| EPSBE2010-10-TH | 0.50 | 1.0 | 0.80 | 0.96 | 10.00 | 50 | 6 | 4 | 6.68 | 10.93 | 11.27 | 11.54 | 11.98 | 13.23 |
| EPSBE2012-1.8-TH | 0.60 | 1.2 | 1.10 | 1.15 | 1.80 | 45 | 6 | 4 | 10.78 | 2.36 | 2.47 | 2.58 | 2.68 | 2.86 |
| EPSBE2012-3.6-TH | 0.60 | 1.2 | 1.10 | 1.15 | 3.60 | 45 | 6 | 4 | 9.46 | 4.27 | 4.45 | 4.61 | 4.75 | 5.01 |
| EPSBE2015-2.25-TH | 0.75 | 1.5 | 1.35 | 1.44 | 2.25 | 45 | 6 | 4 | 10.43 | 2.87 | 2.99 | 3.10 | 3.20 | 3.40 |
| EPSBE2015-4.5-TH | 0.75 | 1.5 | 1.35 | 1.44 | 4.50 | 45 | 6 | 4 | 8.84 | 5.24 | 5.43 | 5.61 | 5.76 | 6.03 |
| EPSBE2015-8-TH | 0.75 | 1.5 | 1.35 | 1.44 | 8.00 | 45 | 6 | 4 | 7.14 | 8.89 | 9.17 | 9.41 | 9.61 | 10.56 |
| EPSBE2015-12-TH | 0.75 | 1.5 | 1.35 | 1.44 | 12.00 | 50 | 6 | 4 | 5.85 | 13.03 | 13.39 | 13.74 | 14.38 | 15.87 |
| EPSBE2020-3-TH | 1.00 | 2.0 | 1.70 | 1.92 | 3.00 | 45 | 6 | 4 | 9.79 | 3.71 | 3.84 | 3.96 | 4.07 | 4.29 |
| EPSBE2020-4-TH | 1.00 | 2.0 | 1.70 | 1.92 | 4.00 | 45 | 6 | 4 | 9.03 | 4.75 | 4.92 | 5.07 | 5.21 | 5.45 |
| EPSBE2020-6-TH | 1.00 | 2.0 | 1.70 | 1.92 | 6.00 | 45 | 6 | 4 | 7.81 | 6.84 | 7.07 | 7.26 | 7.43 | 7.89 |
| EPSBE2020-8-TH | 1.00 | 2.0 | 1.70 | 1.92 | 8.00 | 45 | 6 | 4 | 6.88 | 8.92 | 9.19 | 9.42 | 9.61 | 10.54 |
| EPSBE2020-12-TH | 1.00 | 2.0 | 1.70 | 1.92 | 12.00 | 50 | 6 | 4 | 5.55 | 13.06 | 13.41 | 13.76 | 14.39 | 15.85 |
| EPSBE2020-16-TH | 1.00 | 2.0 | 1.70 | 1.92 | 16.00 | 50 | 6 | 4 | 4.65 | 17.19 | 17.59 | 18.32 | 19.17 | 21.16 |
| EPSBE2020-20-TH | 1.00 | 2.0 | 1.70 | 1.92 | 20.00 | 55 | 6 | 4 | 4.01 | 21.30 | 21.90 | 22.88 | 23.96 | 26.47 |

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EPSBE Cutting Conditions Semi-finishing (Metric)



| Work Material | | | | | Pre-Harden Steels (35 - 45HRC) | Hardened Steels (45 - 55HRC) | Hardened Steels (55 - 65HRC) | Hardened Steels (65 - 68HRC) | Hardened Steels (68 - 72HRC) | | | | | |
|--------------------------------|-----------|-------------------|-----------------------|-------|-----------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-------------|---------|-------------|---------|-------------|
| Ratio to standard depth of cut | | | | | 100% | 85% | 80% | 65% | 55% | | | | | |
| R | Mill dia. | Under neck length | Standard Depth of cut | | n (RPM) | vf (mm/min) | n (RPM) | vf (mm/min) | n (RPM) | vf (mm/min) | n (RPM) | vf (mm/min) | n (RPM) | vf (mm/min) |
| | | | ap | ae | | | | | | | | | | |
| 0.05 | 0.1 | 0.15 | 0.006 | 0.018 | 59,500 | 360 | 54,100 | 320 | 51,400 | 280 | 46,000 | 250 | 43,300 | 190 |
| 0.05 | 0.1 | 0.30 | 0.005 | 0.015 | 59,500 | 360 | 50,000 | 320 | 51,400 | 280 | 46,000 | 250 | 43,300 | 190 |
| 0.10 | 0.2 | 0.30 | 0.016 | 0.048 | 55,400 | 660 | 50,400 | 600 | 47,900 | 520 | 42,800 | 460 | 40,300 | 360 |
| 0.10 | 0.2 | 0.60 | 0.014 | 0.042 | 55,400 | 660 | 50,400 | 600 | 47,900 | 520 | 42,800 | 460 | 40,300 | 360 |
| 0.15 | 0.3 | 0.45 | 0.017 | 0.051 | 50,600 | 910 | 46,000 | 830 | 43,700 | 710 | 39,100 | 630 | 36,800 | 500 |
| 0.15 | 0.3 | 0.90 | 0.017 | 0.051 | 50,600 | 910 | 46,000 | 830 | 43,700 | 710 | 39,100 | 630 | 36,800 | 500 |
| 0.15 | 0.3 | 1.50 | 0.013 | 0.039 | 37,900 | 610 | 34,500 | 560 | 32,800 | 480 | 29,300 | 430 | 27,600 | 340 |
| 0.15 | 0.3 | 2.00 | 0.010 | 0.030 | 30,300 | 470 | 27,600 | 430 | 26,200 | 370 | 23,400 | 330 | 22,100 | 260 |
| 0.20 | 0.4 | 0.60 | 0.035 | 0.105 | 43,800 | 1,050 | 39,800 | 960 | 37,800 | 820 | 33,800 | 730 | 31,800 | 570 |
| 0.20 | 0.4 | 1.20 | 0.032 | 0.096 | 43,800 | 1,050 | 39,800 | 960 | 37,800 | 820 | 33,800 | 730 | 31,800 | 570 |
| 0.20 | 0.4 | 2.00 | 0.022 | 0.066 | 35,000 | 840 | 31,800 | 760 | 30,200 | 650 | 27,100 | 590 | 25,500 | 460 |
| 0.20 | 0.4 | 3.00 | 0.013 | 0.039 | 28,000 | 630 | 25,500 | 570 | 24,200 | 490 | 21,600 | 440 | 20,400 | 340 |
| 0.25 | 0.5 | 0.75 | 0.036 | 0.108 | 37,300 | 1,190 | 34,000 | 1,090 | 32,300 | 930 | 28,900 | 830 | 27,200 | 650 |
| 0.25 | 0.5 | 1.50 | 0.036 | 0.108 | 37,300 | 1,190 | 34,000 | 1,090 | 32,300 | 930 | 28,900 | 830 | 27,200 | 650 |
| 0.25 | 0.5 | 3.00 | 0.024 | 0.072 | 28,000 | 840 | 25,500 | 770 | 24,200 | 650 | 21,600 | 580 | 20,400 | 460 |
| 0.30 | 0.6 | 0.90 | 0.040 | 0.120 | 35,000 | 1,430 | 31,800 | 1,300 | 30,200 | 1,110 | 27,100 | 1,000 | 25,500 | 780 |
| 0.30 | 0.6 | 1.80 | 0.036 | 0.108 | 35,000 | 1,430 | 31,800 | 1,300 | 30,200 | 1,110 | 27,100 | 1,000 | 25,500 | 780 |
| 0.30 | 0.6 | 3.00 | 0.028 | 0.084 | 27,000 | 1,100 | 24,500 | 1,000 | 23,300 | 860 | 20,900 | 770 | 19,600 | 600 |
| 0.30 | 0.6 | 5.00 | 0.018 | 0.054 | 22,200 | 910 | 20,200 | 820 | 19,200 | 710 | 17,100 | 630 | 16,100 | 490 |
| 0.30 | 0.6 | 6.00 | 0.013 | 0.039 | 22,200 | 830 | 20,200 | 750 | 19,200 | 640 | 17,100 | 570 | 16,100 | 450 |
| 0.40 | 0.8 | 1.20 | 0.065 | 0.195 | 29,200 | 1,680 | 26,500 | 1,530 | 25,200 | 1,310 | 22,500 | 1,170 | 21,200 | 920 |
| 0.40 | 0.8 | 2.40 | 0.065 | 0.195 | 29,200 | 1,680 | 26,500 | 1,530 | 25,200 | 1,310 | 22,500 | 1,170 | 21,200 | 920 |
| 0.50 | 1.0 | 1.50 | 0.080 | 0.240 | 28,600 | 2,060 | 26,000 | 1,870 | 24,700 | 1,600 | 22,100 | 1,430 | 20,800 | 1,120 |
| 0.50 | 1.0 | 3.00 | 0.080 | 0.240 | 28,600 | 2,060 | 26,000 | 1,870 | 24,700 | 1,600 | 22,100 | 1,430 | 20,800 | 1,120 |
| 0.50 | 1.0 | 4.00 | 0.060 | 0.180 | 25,500 | 1,840 | 23,200 | 1,670 | 22,000 | 1,430 | 19,700 | 1,270 | 18,500 | 1,000 |
| 0.50 | 1.0 | 6.00 | 0.035 | 0.105 | 22,300 | 1,610 | 20,300 | 1,460 | 19,300 | 1,250 | 17,200 | 1,110 | 16,200 | 870 |
| 0.50 | 1.0 | 8.00 | 0.035 | 0.105 | 19,300 | 1,350 | 17,500 | 1,230 | 16,600 | 1,050 | 14,900 | 940 | 14,000 | 740 |
| 0.50 | 1.0 | 10.00 | 0.022 | 0.066 | 19,300 | 1,270 | 17,500 | 1,160 | 16,600 | 990 | 14,900 | 890 | 14,000 | 690 |
| 0.60 | 1.2 | 1.80 | 0.080 | 0.240 | 25,300 | 2,190 | 23,000 | 1,990 | 21,800 | 1,700 | 19,500 | 1,520 | 18,400 | 1,190 |
| 0.60 | 1.2 | 3.60 | 0.080 | 0.240 | 25,300 | 2,190 | 23,000 | 1,990 | 21,800 | 1,700 | 19,500 | 1,520 | 18,400 | 1,190 |
| 0.75 | 1.5 | 2.25 | 0.085 | 0.255 | 21,400 | 2,310 | 19,500 | 2,110 | 18,500 | 1,800 | 16,500 | 1,600 | 15,600 | 1,260 |
| 0.75 | 1.5 | 4.50 | 0.080 | 0.240 | 21,400 | 2,310 | 19,500 | 2,110 | 18,500 | 1,800 | 16,500 | 1,600 | 15,600 | 1,260 |
| 0.75 | 1.5 | 8.00 | 0.050 | 0.150 | 18,300 | 1,870 | 16,700 | 1,700 | 15,800 | 1,450 | 14,200 | 1,300 | 13,300 | 1,020 |
| 0.75 | 1.5 | 12.00 | 0.050 | 0.150 | 16,600 | 1,590 | 15,100 | 1,450 | 14,400 | 1,240 | 12,900 | 1,110 | 12,100 | 870 |
| 1.00 | 2.0 | 3.00 | 0.160 | 0.480 | 18,400 | 2,650 | 16,700 | 2,400 | 15,900 | 2,060 | 14,200 | 1,840 | 13,400 | 1,450 |
| 1.00 | 2.0 | 4.00 | 0.160 | 0.480 | 18,400 | 2,650 | 16,700 | 2,400 | 15,900 | 2,060 | 14,200 | 1,840 | 13,400 | 1,450 |
| 1.00 | 2.0 | 6.00 | 0.160 | 0.480 | 18,400 | 2,650 | 16,700 | 2,400 | 15,900 | 2,060 | 14,200 | 1,840 | 13,400 | 1,450 |
| 1.00 | 2.0 | 8.00 | 0.130 | 0.390 | 18,400 | 2,650 | 16,700 | 2,400 | 15,900 | 2,060 | 14,200 | 1,840 | 13,400 | 1,450 |
| 1.00 | 2.0 | 12.00 | 0.070 | 0.210 | 15,300 | 1,960 | 13,900 | 1,780 | 13,200 | 1,520 | 11,800 | 1,360 | 11,100 | 1,070 |
| 1.00 | 2.0 | 16.00 | 0.070 | 0.210 | 14,600 | 1,750 | 13,300 | 1,600 | 12,600 | 1,360 | 11,300 | 1,220 | 10,600 | 950 |
| 1.00 | 2.0 | 20.00 | 0.045 | 0.135 | 13,500 | 1,620 | 12,300 | 1,480 | 11,600 | 1,250 | 10,400 | 1,120 | 9,800 | 880 |