Ultrafast beam cutting of quartz with a tailored beam filamentation

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By using a non-diffraction Bessel beam, quartz plate was cut with zero taper. Comparing to other high hardness and strength transparent material, quartz is more difficult to cut. In this work, the Bessel beam was combined with radial-polarization and a vortex wavefront of different orbital angular momentum (OAM). It is well known that the vortex wavefront transforms the Gaussian beam into an annular intensity distribution in Fourier plane, which enlarges the laser material interaction area, to enhance materials processing. The radial-polarization contributed to p-polarization, perpendicular to the sidewall, which enlarged the laser beam absorption of material, to improve cutting quality.