Claims

[Claim 1]

A cutting method comprising a cutting step of cutting a workpiece material with a cutting tool to thereby form a through-groove in the workpiece material, wherein

in the cutting step, the through-groove is formed in the workpiece material by cutting the workpiece material with the cutting tool while contacting a cut-assisting lubricant with a contact portion of the cutting tool with the workpiece material, a contact portion of the workpiece material with the cutting tool, or a contact portion of the cutting tool with the workpiece material and a contact portion of the workpiece material with the cutting tool, and

the workpiece material comprises a fiber reinforced composite material, and wherein

the cut-assisting lubricant contains

a high molecular weight compound (A) having a weight average molecular weight of 5.0×10^4 or higher and 1.0×10^6 or lower,

a medium molecular weight compound (B) having a weight average molecular weight of 1.0×10^3 or higher and lower than 5.0×10^4, and

a carbon (C) having an average particle size of 100 μm or larger.

[Claim 2]

The cutting method according to claim 1, wherein the cutting step comprises the steps of: cutting the workpiece material with the cutting tool to thereby form a through-hole in the workpiece material; and forming the through-groove in the workpiece material by cutting the workpiece material while moving the cutting tool inserted in the through-hole in a direction orthogonal or substantially orthogonal to the penetration direction of the through-hole.

[Claim 3]

The cutting method according to claim 1 or 2, wherein the cutting method comprises a close contact step of closely contacting in advance the cut-assisting lubricant with a portion to serve as a starting point for forming the through-groove.

[Claim 4]

The cutting method according to claim 1 or 2, wherein the cutting method comprises a close contact step of closely contacting in advance the cut-assisting lubricant with the whole surface of a region where the through-groove is to be formed.

[Claim 5]

The cutting method according to claim 1 or 2, wherein the cutting tool is a router bit.

[Claim 6]

The cutting method according to claim 1, wherein the shape of the carbon (C) is a flake shape.

[Claim 7]

The cutting method according to claim 1, wherein the high molecular weight compound (A) comprises a thermoplastic resin having a weight average molecular weight of 5.0×10^4 or higher and 1.0×10^6 or lower, and the medium molecular weight compound (B) comprises a thermoplastic resin having a weight average molecular weight of 1.0×10^3 or higher and 2.0×10^4 or lower.

[Claim 8]

The cutting method according to claim 1, wherein the high molecular weight compound (A) comprises a water soluble thermoplastic resin, a non-water soluble thermoplastic resin, or a water soluble thermoplastic resin and a non-water soluble thermoplastic resin, wherein

the water soluble thermoplastic resin is one or more resins selected from the group consisting of a polyalkylene oxide compound, a polyalkylene glycol

compound, an ester compound of polyalkylene glycol, an ether compound of polyalkylene glycol, a monostearate compound of polyalkylene glycol, a water soluble urethane, a water soluble polyether resin, a water soluble polyester, sodium poly(meth)acrylate, polyacrylamide, polyvinylpyrrolidone, polyvinyl alcohol, saccharides, and modified polyamide, and

the non-water soluble thermoplastic resin is one or more resins selected from the group consisting of a urethane polymer, an acrylic polymer, a vinyl acetate polymer, a vinyl chloride polymer, a polyester polymer, a polystyrene resin, and a copolymer thereof.

[Claim 9]

The cutting method according to claim 1, wherein

the medium molecular weight compound (B) is one or more compounds selected from the group consisting of a polyalkylene glycol compound, a monoether compound of polyalkylene oxide, a monostearate compound of polyalkylene oxide, and a polyalkylene oxide compound.

[Claim 10]

The cutting method according to claim 1, wherein

in the cut-assisting lubricant,

the content of the high molecular weight compound (A) is 20 to 60 parts by mass with respect to 100 parts by mass in total of the high molecular weight compound

(A), the medium molecular weight compound (B), and the carbon (C),

the content of the medium molecular weight compound (B) is 10 to 75 parts by mass with respect to 100 parts by mass in total of the high molecular weight compound (A), the medium molecular weight compound (B), and the carbon (C), and

the content of the carbon (C) is 5 to 70 parts by mass with respect to 100 parts by mass in total of the high molecular weight compound (A), the medium molecular weight compound (B), and the carbon (C).

[Claim 11]

The cutting method according to claim 1 or 2, wherein

the cut-assisting lubricant is in the form of a sheet having a thickness of 0.1 mm or larger.

[Claim 12]

The cutting method according to claim 1 or 2, wherein

when the cut-assisting lubricant is removed from the workpiece material after the cutting work, the amount of a component of the cut-assisting lubricant attached to the workpiece material is 1.0×10^{-8} g or smaller per mm^2 of the areas of the contact portion between the workpiece

material and the cut-assisting lubricant, and the processed portion.

[Claim 13]

The cutting method according to claim 1 or 2, wherein

the cut-assisting lubricant has an adhesive layer on a face to be contacted with the workpiece material.

[Claim 14]

The cutting method according to claim 13, wherein

the adhesive layer comprises an acrylic polymer.

[Claim 15]

The cutting method according to claim 13, wherein

when the cut-assisting lubricant is removed from the workpiece material after the cutting work, the amount of a component of the cut-assisting lubricant or the adhesive layer attached to the workpiece material, or a component of the cut-assisting lubricant and the adhesive layer attached to the workpiece material is 1.0×10^{-8} g or smaller per mm^2 of the areas of the contact portion between the workpiece material and the cut-assisting lubricant, and the processed portion.

[Claim 16]

The cutting method according to claim 1 or 2, wherein

the fiber reinforced composite material is a carbon fiber reinforced plastic.