Claims

1. A multiple-axis hybrid manufacturing machine tool (1) for manufacturing a three-dimensional part, in particular a micro-part and/or a macro-part with a micro-feature, wherein the multiple-axis hybrid manufacturing machine tool (1) extends in a first direction (1001), a second direction (1002) and a third direction (1003) that are perpendicular to each other and, when assembled, comprises:

   • a vat photopolymerization three-dimensional printing module (100) comprising a movable illumination device (101),

   • a container module (200) comprising at least one photopolymer receiving container (201) for receiving a photopolymer in liquid phase,

   • a CNC processing module (300) comprising a movable milling spindle (301) for holding a milling tool and/or a measuring tool, and

   • a platform module (400) comprising a movable build platform (401) that is arranged and configured for vat photopolymerization three-dimensional printing of a work piece and/or on a work piece, and preferably also for CNC processing of a work piece, on the build platform (401),

   wherein the movable build platform (401) is configured to linearly move in the third direction (1003), wherein the linear movement of the build platform (401) in the third direction (1003) is continuously controllable,

   wherein the movable build platform (401) is configured to rotate around the second direction (1002), wherein the rotational movement of the build platform (401) around the second direction (1002) is continuously controllable,

   wherein the milling spindle (301) is configured to linearly move in the first direction (1001) and/or second direction (1002) and/or to rotate around the third direction (1003), wherein the linear movement of the milling spindle (301) in the first direction (1001) and/or in the second direction (1002) and/or the rotational movement of the milling spindle (301) around the third direction (1003) is/are continuously controllable, and

   wherein the movable build platform (401) and the milling spindle (301) are controllable such that the linear movement in the third direction (1003) and the rotational movement around the second direction (1002) of the movable build platform (401) are simultaneous with at least one of the movements of the milling spindle (301).

2. The multiple-axis hybrid manufacturing machine tool (1) according to claim 1, wherein the movable build platform (401) is configured to rotate also around the third direction (1003), preferably wherein the rotational movement of the build platform (401) around the third direction (1003) is continuously controllable.

3. The multiple-axis hybrid manufacturing machine tool (1) according to any of the preceding claims, wherein the movable build platform (401) is interchangeable,
and/or
wherein the movable build platform (401) is configured to support a work piece to be processed by the milling tool and/or measured by the measuring tool,
optionally wherein the movable illumination device (101) is configured to linearly move in the third direction (1003), and in particular also in the second direction (1002), preferably wherein the linear movement of the movable illumination device (101) in the third direction (1003), and in particular also in the second direction (1002), is/are controllable continuously or in steps or in an indexed manner,
optionally wherein the at least one photopolymer receiving container (201) is configured to linearly move and/or indexed in the first direction (1001),
optionally wherein the container module (200) comprises at least one material receiving container (202) for receiving a washing liquid and/or a coating agent,
optionally wherein the at least one material receiving container (202) is configured to linearly move and/or indexed in the first direction (1001), in particular wherein the at least one photopolymer receiving container (201) and the at least one material receiving container (202) are configured such they are linearly movable and/or indexed together in the first direction (1001),
optionally wherein the milling spindle (301) is configured to simultaneously linearly move in the first direction (1001) and/or second direction (1002) and/or rotate around the third direction (1003), preferably wherein the linear movement of the milling spindle (301) in the first direction (1001) and/or in the second direction (1002) and/or the rotational movement of the milling spindle (301) around the third direction (1003) is/are continuously controllable, and/or wherein the milling spindle (301) is configured to drive the milling tool around a milling spindle axis (310) for performing a cutting process on a work piece, and/or
optionally the multiple-axis hybrid manufacturing machine tool (1) further comprising a post-processing module (500), wherein the post-processing module (500) comprises a UV-light illumination device (508) and/or a fluid providing means (508) for providing a fluid, in particular a gas, which is/are preferably arranged inside a housing (501) of the post-processing module (500), preferably wherein the housing (501) is stationary and/or configured to block UV-light.

4. The multiple-axis hybrid-manufacturing machine tool (1) according to claim 3, wherein the CNC processing module (300) is arranged on a first side of the platform module (400) in the first direction (1001) and the post-processing module (500) is arranged on a second side of the platform module (400) in the first direction (1001).

5. The multiple-axis hybrid manufacturing machine tool (1) according to any of the preceding claims, further comprising an extrusion and/or inkjet printhead module (600) with a head

mount arrangement (606), wherein the head mount arrangement (606) comprises at least one movable head mount (660) for mounting at least one head (670), wherein the at least one head (670) comprises an extrusion print head and/or an inkjet print head, in particular wherein the at least one head also comprises a laser head and/or a syringe for bio plotting, preferably wherein the at least one movable head mount is configured to linearly move in the first direction (1001) and/or the second direction (1002),

or

further comprising a generic module (1100) with a head mount arrangement (606), wherein the head mount arrangement (606) comprises at least one movable head mount (660) for mounting at least one head (670), wherein the at least one head (670) comprises an extrusion print head and/or an inkjet print head and/or a laser head and/or a syringe for bio plotting, preferably wherein the at least one movable head mount is configured to linearly move in the first direction (1001) and/or the second direction (1002).

6. The multiple-axis hybrid manufacturing machine tool (1) according to claim 5, wherein the vat photopolymerization three-dimensional printing module (100) is arranged on a first side of the platform module (400) in the third direction (1003) and the extrusion and/or inkjet printhead module (600) is arranged on a second side of the platform module (400) in the third direction (1003), or wherein the vat photopolymerization three-dimensional printing module (100) is arranged on a first side of the platform module (400) in the third direction (1003) and the generic module (1100) is arranged on a second side of the platform module (400) in the third direction (1003).

7. The multiple-axis hybrid manufacturing machine tool (1) according to any of the preceding claims, further comprising an automatic tool change module (700), wherein the automatic tool change module (700) is configured to receive a milling tool and/or a measuring tool and/or comprises a rotary disc (701) configured to rotate, in particular in an indexed manner, around the second direction (1002).

8. The multiple-axis hybrid manufacturing machine tool (1) according to any of the preceding claims, comprising a support body (800), to which the vat photopolymerization three-dimensional printing module (100), the container module (200), the CNC processing module (300) and the platform module (400) are attached, in particular wherein each module of the multiple-axis hybrid manufacturing machine tool (1) is attached to the support body (800), and/or comprising a sealable and closable chamber (802), inside which the vat photopolymerization three-dimensional printing module (100), the container module (200), the CNC processing module (300) and the platform module (400) are arranged, in particular

wherein each module of the multiple-axis hybrid manufacturing machine tool (1) is arranged inside the sealable and closable chamber (802),

optionally wherein the multiple-axis hybrid manufacturing machine tool (1) further comprises a control means (1000) for controlling, in particular simultaneously, the vat photopolymerization three-dimensional printing module (100) and/or the container module (200) and/or the CNC processing module (300) and/or the platform module (400), in particular for controlling each module of the multiple-axis hybrid manufacturing machine tool (1),

optionally wherein the multiple-axis hybrid manufacturing machine tool (1) is built around the platform module (400), in particular around the movable build platform (401),

optionally wherein the multiple-axis hybrid manufacturing machine tool (1) is set up such that a manufacturing process can be interrupted by another manufacturing process, optionally wherein the movable build platform (401) is configured to simultaneously move in the third direction (1003) and rotate around the second direction (1002), and/or simultaneously rotate around the third direction (1003) and the second direction (1002), and/or simultaneously move linearly in the third direction (1003) and rotate around the third direction (1003), and/or optionally wherein at least one of the previously mentioned modules, in particular all the previously mentioned modules, of the multiple-axis hybrid manufacturing machine tool (1), is/are configured to be under continuous control.

9. The multiple-axis hybrid manufacturing machine tool (1) according to any of the preceding claims, wherein at least one of the previously mentioned modules, in particular all the previously mentioned modules, of the multiple-axis hybrid manufacturing machine tool (1) is/are interchangeable.

10. The multiple-axis hybrid manufacturing machine tool (1) according to any of the preceding claims, wherein the movable illumination device (101) is configured for focusing, in particular autofocusing, at different focal lengths.

11. The multiple-axis hybrid manufacturing machine tool (1) according to any of the preceding claims, the movable build platform (401) is controllable to move during a manufacturing process, in particular a cutting process and/or and extrusion printing process and/or an inkjet printing process and/or bio-plotting process.

12. The multiple-axis hybrid manufacturing machine tool (1) according to any of the preceding claims, wherein the movable build platform (501) is controllable to simultaneously move with the milling spindle (301).

13. The multiple-axis hybrid manufacturing machine tool (1) according to any of claims 5 to 13, wherein the movable build platform (501) is controllable to simultaneously move with the one movable head mount (660).

14. The multiple-axis hybrid manufacturing machine tool (1) according to any of the preceding claims, further comprising a disinfecting unit (900) for filtering and/or sterilization, preferably wherein the disinfecting unit (900) comprises at least one active means for filtering and/or sterilization, in particular wherein the disinfecting unit (900) comprises at least one HEPA filter for filtering out dust and particles and/or at least one UV-light module with proper wavelength for sterilization purposes.

15. The multiple-axis hybrid manufacturing machine tool (1) according to any of the preceding claims, wherein the platform module (400) is stationary in the first direction (1001).