Claims

1. A multi-channel microfluidic blood coagulation detection chip, comprising a chip body, wherein the chip body comprises, in sequence from bottom to top, a lower-layer chip, a middle-layer chip, and an upper-layer chip; the lower-layer chip, the middle-layer chip, and the upper-layer chip cooperate with each other to define a closed microfluidic channel and a plurality of mutually independent detection chambers, the upper-layer chip is provided with a sample loading hole, and the sample loading hole communicates with the detection chambers through the microfluidic channel; the multi-channel microfluidic blood coagulation detection chip is characterized in that the chip body further comprises electrodes, the electrodes comprise upper-layer electrodes and lower-layer electrodes, the upper-layer electrodes are disposed on the back surface of the upper-layer chip, the lower-layer electrodes are disposed on the front surface of the lower-layer chip, and a gap is provided between the upper-layer electrodes and the lower-layer electrodes, wherein the upper-layer electrodes comprise a plurality of electrodes I, and the plurality of electrodes I are all arranged in one-to-one correspondence with the plurality of mutually independent detection chambers; the lower-layer electrodes comprise a plurality of electrodes II, the plurality of electrodes II are all arranged in one-to-one correspondence with the plurality of mutually independent detection chambers, and the electrodes I and the electrodes II are respectively working electrodes or reference electrodes, and one end of the plurality of electrodes II are arranged in one-to-one correspondence with the plurality of mutually independent detection chambers and located in the detection chambers, and the other end of the plurality of electrodes II extend on the front surface of the lower-layer chip to the end head of one end of the lower-layer chip to form detection ends in connection with a detection instrument, and the detection ends are exposed outside the end of an integral whole,

formed by bonding the lower-layer chip, the middle-layer chip and the upper-layer chip, with respect to the upper-layer chip and the middle-layer chip.

2. The multi-channel microfluidic blood coagulation detection chip according to claim 1, wherein both the upper-layer electrodes on the back surface of the upper-layer chip and the lower-layer electrodes on the front surface of the lower-layer chip are arranged corresponding to positions where the detection chambers of the middle-layer chip are located, and the upper-layer electrodes and the lower-layer electrodes communicate with each other through the detection chambers.

3. The multi-channel microfluidic blood coagulation detection chip according to claim 2, wherein the middle-layer chip is provided with middle-layer communication holes at positions corresponding to the upper-layer electrodes, the lower-layer chip is provided with lower-layer communication holes at positions corresponding to the upper-layer electrodes, and the upper-layer electrodes are in contact and connection with the detection instrument through the middle-layer communication holes and the lower-layer communication holes.

4. The multi-channel microfluidic blood coagulation detection chip according to claim 3, wherein both the microfluidic channel and the detection chambers run through the middle-layer chip; the microfluidic channel comprises a main flow channel and a plurality of branching microfluidic channels, the tail end of the main flow channel is divided into the plurality of branching microfluidic channels, and the plurality of branching microfluidic channels communicate in one-to-one correspondence with the plurality of mutually independent detection chambers; and the front end of the main flow channel communicates with the sample loading hole.

5. The multi-channel microfluidic blood coagulation detection chip according to claim 1, wherein one ends of the plurality of electrodes I are arranged in one-to-one correspondence with the plurality of mutually independent detection chambers and located in the detection chambers, and the other ends of the plurality of electrodes I extend on the back surface of the upper-layer chip to the end head of one end of the upper-layer chip to form connection ends in contact and connection with the detection instrument.

6. The multi-channel microfluidic blood coagulation detection chip according to any one of claims 1-~~7~~5, wherein the upper-layer chip is further provided with a plurality of vent holes, and the plurality of vent holes are all arranged in one end of the upper-layer chip and disposed at positions corresponding to the detection chambers.

7. The multi-channel microfluidic blood coagulation detection chip according to claim 5, wherein the connection ends are arranged in one-to-one correspondence with the middle-layer communication holes and the lower-layer communication holes, respectively.

8. The multi-channel microfluidic blood coagulation detection chip according to claim 4, wherein the middle-layer chip is provided with a liquid receiving port, the liquid receiving port is disposed corresponding to the position of the sample loading hole, one end of the main flow channel is connected to the liquid receiving port, the other end of the main flow channel is connected to the detection chambers through the branching microfluidic channels, and the width of the detection chambers is greater than the width of the branching microfluidic channels.

9. The multi-channel microfluidic blood coagulation detection chip according to claim 8, wherein the main flow channel extends in a horizontal direction to the end away from the liquid receiving port to be provided with a branching microfluidic channel I that is connected to a detection chamber I; the main flow channel extends in a vertical direction to the end away from the liquid receiving port towards both sides respectively to be provided with a branching microfluidic channel II and a branching microfluidic channel III; the branching microfluidic channel II extends in a direction parallel to the main flow channel to both ends respectively to connect to a detection chamber II and a detection chamber III, and the branching microfluidic channel III extends in the direction parallel to the main flow channel to both ends respectively to connect to a detection chamber IV and a detection chamber V.

10. The multi-channel microfluidic blood coagulation detection chip according to claim 7, wherein the number of both the electrodes I and the electrodes II is five, and correspondingly, the number of both the middle-layer communication holes and the lower-layer communication holes is five.

11. The multi-channel microfluidic blood coagulation detection chip according to claim 7, wherein each of the connection ends is a rectangle of the same size, and the spacing between each two of the connection ends is equal; correspondingly, each of the middle-layer communication holes and each of the lower-layer communication holes are both rectangles of the same size, and the spacing between each two of the middle-layer communication holes and the spacing between each two of the lower-layer communication holes are both equal; the size of the connection ends is greater than or equal to the size of the middle-layer communication holes and the lower-layer communication holes; and the middle-layer communication holes have the same size as the lower-layer communication holes.

12. The multi-channel microfluidic blood coagulation detection chip according to claim 1, wherein the shape of each of the detection ends is rectangular and the spacing between each two of the detection ends is equal; and the length of the detection ends exposed outside the end of the integral whole, formed by bonding the lower-layer chip, the middle-layer chip and the upper-layer chip, with respect to the upper-layer chip and the middle-layer chip is not more than 1 cm.

13. The multi-channel microfluidic blood coagulation detection chip according to claim 6, wherein the plurality of the vent holes are all disposed in the ends of the detection chambers away from the branching microfluidic channels and at corresponding positions flush with the edges of the detection chambers.