Claims

1. A cardiac pacemaker (100), characterized in that the cardiac pacemaker (100) comprises a multiple of microneedles (10) forming an array of microneedles (10);
   a chip (20) comprising at least one comparator with adaptive level, a sequence control circuit, at least one capacitor stack built by n capacitors and 2n switches, at least one buffer capacitor outside the at least one capacitor stack, at least two additional switches outside the at least one capacitor stack and a CMOS-Logic, wherein $n \in N$;
   an interposer layer (30) comprising holes (31) for the multiple of microneedles (10);
   a lid (40);
   at least one coil (800);
   wherein the chip (20), is located on one surface of the interposer layer (30);
   wherein the lid (40) and the interposer layer (30) form a capsule for the chip (20) and the at least one coil (800);
   wherein each microneedle (10) has a distal end which protrudes from the chip (20); and
   wherein the cardiac pacemaker (100) is adapted to be electrically self-sufficient due to harvesting of electrical energy from myocardial cells.

2. A cardiac pacemaker (100) according to claim 1, characterized in that the cardiac pacemaker (100) further comprises at least one sensor (50) and/or at least one further capacitor (60).

3. A cardiac pacemaker (100) according to claim 2, characterized in that the sensor (50) is implemented as a micromechanical (MEMS) activity sensor, an electrostatical accelerometer or a piezoceramic accelerometer.

4. A cardiac pacemaker (100) according to any of the preceding claims, characterized in that the cardiac pacemaker (100) comprises between 5 and 10000 microneedles (10), preferably between 25 and 1000 microneedles (10), most preferably between 100 and 250 microneedles (10).

5. A cardiac pacemaker (100) according to any of the preceding claims, characterized in that the cardiac pacemaker (100) further comprises an external programmer unit (900a, 900b).

6. A cardiac pacemaker (100) according to any of the preceding claims, characterized in that every microneedle (10) is adapted to be operable independent of the other microneedles (10).

7. A cardiac pacemaker (100) according to any of the preceding claims, characterized in that the cardiac pacemaker (100) is between 1 mm and 8 cm long, between 1 mm and 5 mm wide and between 3 mm and 10 mm high.

8. A cardiac pacemaker (100) according to any of the preceding claims, characterized in that the diameters of the distal ends (14) of the multiple of microneedles are between 0.001 mm and 0.1 mm, preferably between 0.01 mm and 0.1 mm, most preferably the diameters of the distal ends (14) of the multiple of microneedles are 0.02 mm.

9. A cardiac pacemaker (100) according to any of the preceding claims, characterized in that the microneedles (10) comprise a material of the group comprising Platin/Iridium (PtIr), gold, and fine metals.

10. A cardiac pacemaker (100) according any of the preceding claims, characterized in that each microneedle (10) is adapted to be able to harvest cellular energy, to electrically stimulate live tissue and to sense intrinsic cellular electrical activity.

11. A cardiac pacemaker (100) according to any of the preceding claims, characterized in that the interposer layer (30) further comprises at least two fixation holes (70, 71) outside the lid (40).