Electronic supplementary information (ESI) for PCCP.

Supporting information

Motion of Chemically Reactive Bimetal Motor in the Magnetic Field

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Supporting Videos

Video S1: Locomotion of aluminum-copper surfer at the surface of distilled water (AVI).

Video S2: Locomotion of aluminum-copper surfer at the surface of copper (II) sulfate solution (AVI).

Video S3: Surfer does not move with the magnet if the distance between them is larger than a certain maximal value (AVI).

Video S4: Locomotion of perforated aluminum-copper surfer at the surface of copper (II) sulfate solution (AVI).

Experimental section

The following materials were used in the experiments. Copper (II) sulfate ($\geq 99.0\ \%$) was obtained from Merck and used without additional purification. To produce surfers the following foils were used: copper ($\geq 99.99\ \%$, thickness $76\ \mu m$), aluminum ($\geq 99.99\ \%$, $80\ \mu m$), tin ($\geq 99.99\ \%$, $50\ \mu m$), indium ($\geq 99.995\ \%$, $50\ \mu m$), plumbum ($\geq 99.99\ \%$, $50\ \mu m$), zinc ($\geq 99.995\ \%$, $50\ \mu m$).

Bimetal surfer was produced via soldering of two types of metal foils. A low melting point ($68\ ℃$) Wood's alloy was used as solder. Every surfer had the same size $10 \times 30\ mm$. Surfer consisted of two equal parts representing anode and cathode of size $10 \times 15\ mm$. When producing perforated surfer the holes of $1\ mm$ diameter were drilled in the foil. Homogeneous surfer with geometric size $10 \times 30\ mm$ was completely made of zinc foil.

First, the given amount of copper (II) sulfate was dissolved in the distilled water. Further, the solution was heated or cooled with the help of the thermostat HUBER K6-CC. The conductivity of the solution (Figure S2) was measured with a conductometer. The surfer was put at the solution-air interface, and it was allowed to float freely at the interface. The permanent neodymium-iron-boron magnet was placed and moved at the fixed height above the surfer surface. The magnet had a cylindrical shape of $18\ mm$ diameter and $3\ mm$ height. The magnetic field strength was measured with the help of magnetometer TD8620 (Changsha Tunkia) (Figure S1). A screw mechanism was used to move a magnet. The distance between the magnet and surfer was regulated with the help of plates of a given thickness. Magnet was fixed on the console and was moving in reciprocating manner at the given height above the surfer. In the process of experiments, we estimated the maximal height of the magnet above the surfer surface at which the surfer still moved together with the magnet. In all the experiments, the magnet was moving with a constant velocity of $5\ mm \cdot s^{-1}$. Each test was repeated five times. New samples of electrolyte solution and surfer were used in each test.

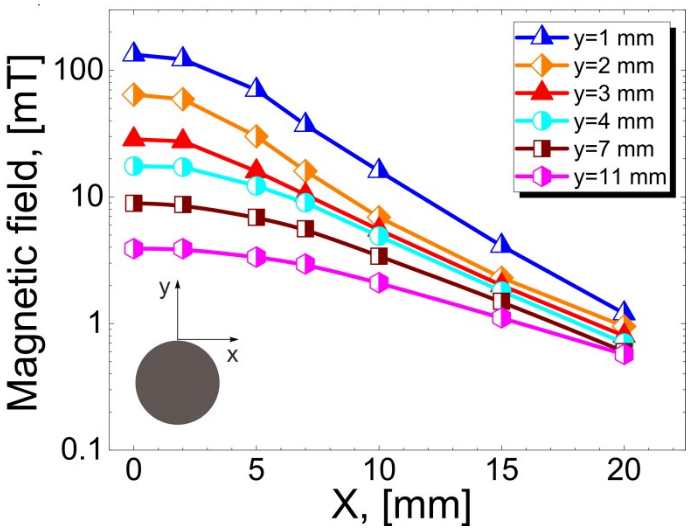

Figure S1 Intensity of magnetic field near the permanent magnet (x, y coordinates are shown in the insert).

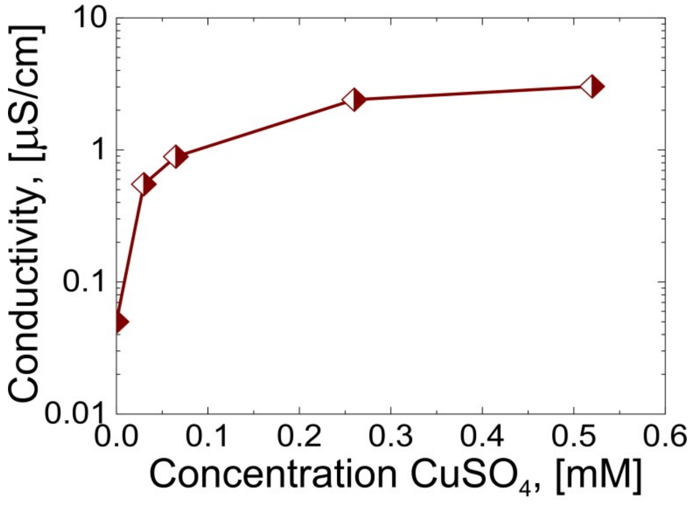

Figure S2 Effect of the copper (II) sulfate concentration in the aqueous solution on the conductivity (22 ℃).