Electronic Supplementary Material (ESI) for Lab on a Chip.

Electronic Supplementary Information

In situ synthesis of $[Cu(BODN)\cdot 5H_2O]_n$@nano-Al composite energetic films with tunable properties in pyro-MEMS

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1. Schematic diagram for preparing $[Cu(BODN)\cdot 5H_2O]_n$ single crystal

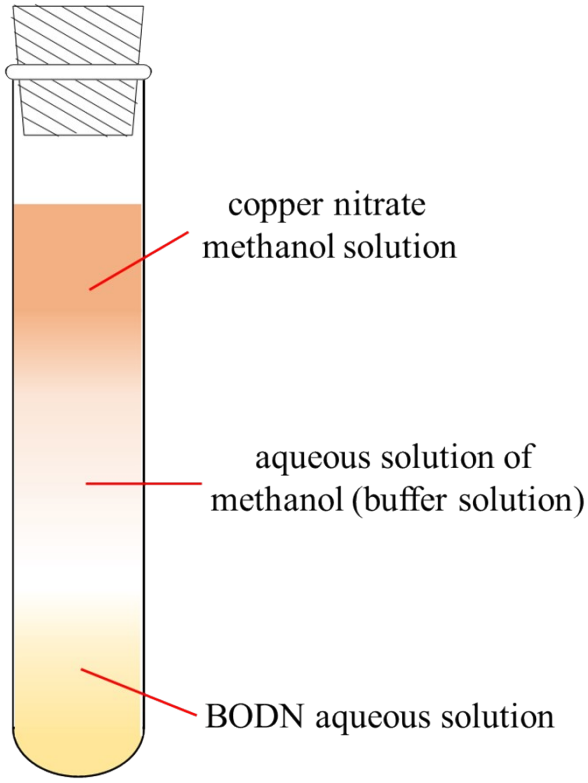

Fig. S1 Schematic diagram for preparing $[Cu(BODN)\cdot 5H_2O]_n$ single crystal by liquid-phase diffusion method

2. Single-crystal X-ray Diffraction Analysis of $[Cu(BODN)\cdot 5H_2O]_n$

Table S1 Selected bond lengths [Å] of $[Cu(BODN)\cdot 5H_2O]_n$

Atom	Atom	Length/Å	Atom	Atom	Length/Å
Cu^1	O^3	1.992(2)	N^6	C^4	1.314(4)
Cu^1	O^4	1.971(2)	O^2	N^8	1.228(4)
Cu^1	O^{111}	2.310(3)	N^5	C^3	1.282(4)
Cu^1	N^6	1.986(3)	N^3	N^4	1.403(4)
Cu^1	N^{31}	1.980(3)	N^3	C^1	1.315(4)
Cu^1	O^1	2.261(3)	O^1	N^8	1.245(4)
O^9	C^1	1.367(4)	N^4	C^2	1.281(4)
O^9	C^2	1.353(4)	N^7	N^8	1.342(3)
O^5	C^4	1.371(4)	N^7	C^4	1.340(4)
O^5	C^3	1.357(4)	N^1	N^2	1.338(4)
O^{11}	N^1	1.251(4)	N^2	C^1	1.343(4)
O^{10}	N^1	1.238(4)	C^3	C^2	1.446(4)
N^6	N^5	1.401(4)			

Table S2 Selected bond angles [Å] of $[Cu(BODN)\cdot 5H_2O]_n$

Atom	Atom	Atom	Angle/°	Atom	Atom	Atom	Angle/°
O^{3}	Cu^{1}	O^{111}	90.19(10)	C^{1}	N^{3}	N^{4}	107.7(2)
O^{3}	Cu^{1}	O^{1}	92.05(11)	N^{8}	O^{1}	Cu^{1}	135.8(2)
O^{4}	Cu^{1}	O^{3}	178.63(11)	C^{2}	N^{4}	N^{3}	104.6(3)
O^{4}	Cu^{1}	O^{111}	88.60(10)	C^{4}	N^{7}	N^{8}	116.1(3)
O^{4}	Cu^{1}	N^{6}	89.25(10)	O^{2}	N^{8}	O^{1}	120.0(3)
O^{4}	Cu^{1}	N^{31}	90.48(10)	O^{2}	N^{8}	N^{7}	116.7(3)
O^{4}	Cu^{1}	O^{1}	89.18(11)	O^{1}	N^{8}	N^{7}	123.2(3)
N^{6}	Cu^{1}	O^{3}	90.44(10)	O^{11}	N^{1}	N^{2}	123.5(3)
N^{6}	Cu^{1}	O^{111}	104.76(10)	O^{10}	N^{1}	O^{11}	120.5(3)
N^{6}	Cu^{1}	O^{1}	77.15(10)	O^{10}	N^{1}	N^{2}	116.0(3)
N^{31}	Cu^{1}	O^{3}	89.87(10)	N^{1}	N^{2}	C^{1}	116.6(3)
N^{31}	Cu^{1}	O^{111}	76.96(10)	N^{6}	C^{4}	O^{5}	110.2(3)
N^{31}	Cu^{1}	N^{6}	178.26(12)	N^{6}	C^{4}	N^{7}	137.3(3)
N^{31}	Cu^{1}	O^{1}	101.12(10)	N^{7}	C^{4}	O^{5}	112.5(3)
O^{1}	Cu^{1}	O^{111}	177.05(9)	N^{3}	C^{1}	O^{9}	110.2(3)
C^{2}	O^{9}	C^{1}	102.9(2)	N^{3}	C^{1}	N^{2}	137.5(3)
C^{3}	O^{5}	C^{4}	102.9(2)	N^{2}	C^{1}	O^{9}	112.3(3)
N^{1}	O^{11}	Cu^{12}	134.4(2)	O^{5}	C^{3}	C^{2}	119.3(3)
N^{5}	N^{6}	Cu^{1}	121.4(2)	N^{5}	C^{3}	O^{5}	114.2(3)
C^{4}	N^{6}	Cu^{1}	129.8(2)	N^{5}	C^{3}	C^{2}	126.5(3)
C^{4}	N^{6}	N^{5}	107.8(2)	O^{9}	C^{2}	C^{3}	117.1(3)
C^{3}	N^{5}	N^{6}	104.9(3)	N^{4}	C^{2}	O^{9}	114.5(3)
N^{4}	N^{3}	Cu^{12}	121.1(2)	N^{4}	C^{2}	C^{3}	128.3(3)
C^{1}	N^{3}	Cu^{12}	130.3(2)				

3. Morphologies of the samples prepared under different conditions

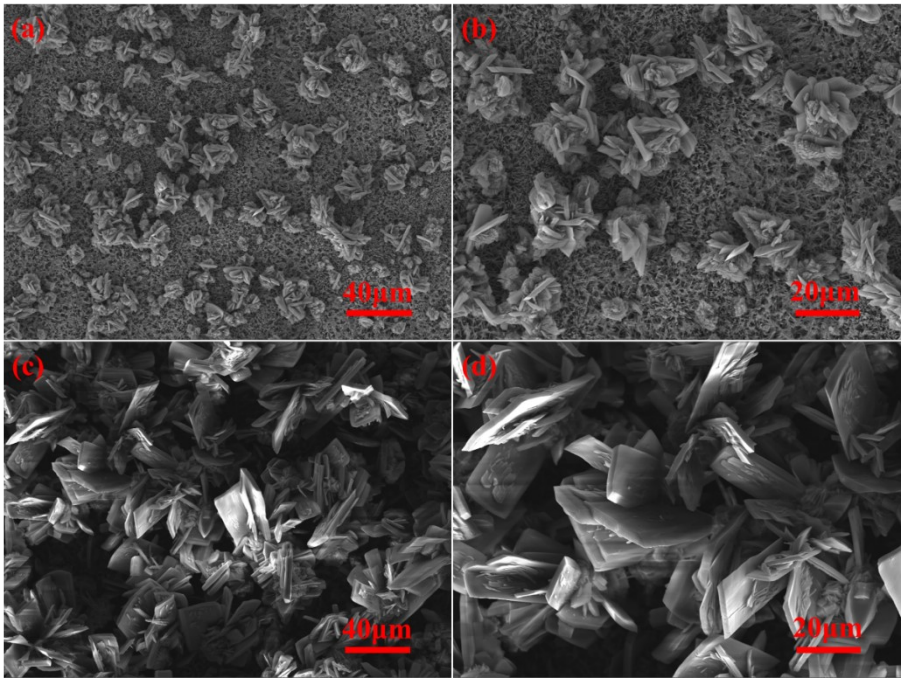

Fig. S2 (a) and (b) represent low and high magnification SEM images of $[Cu(BODN)\cdot 5H_2O]_n$ arrays prepared by reaction for 5 min, (c) and (d) represent low and high magnification SEM images of $[Cu(BODN)\cdot 5H_2O]_n$ arrays prepared by reaction for 20 min.

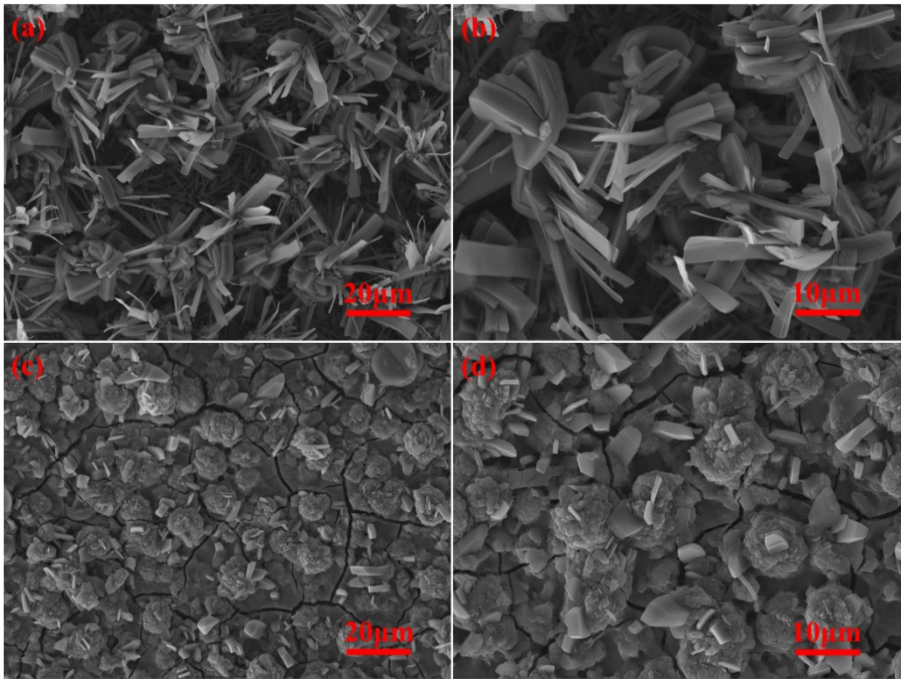

Fig. S3 (a) and (b) represent the low and high magnification SEM images of $[Cu(BODN)\cdot 5H_2O]_n$ arrays prepared at a solution concentration of 2 $g\cdot L^{-1}$, (c) and (d) represent the low and high magnification SEM images of $[Cu(BODN)\cdot 5H_2O]_n$ arrays prepared at a solution concentration of 6 $g\cdot L^{-1}$.

4. The TG curve of $[Cu(BODN)\cdot 5H_2O]_n$ crystals

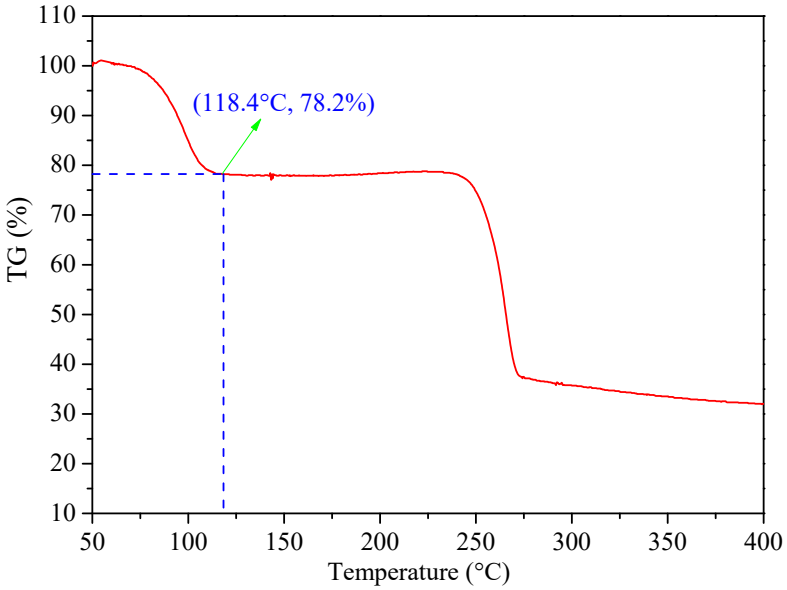

Fig. S4 The TG curve of $[Cu(BODN)\cdot 5H_2O]_n$ crystals

5. The composition of energetic films estimated by the heat releases

Table S3 The composition of energetic films estimated by the heat releases

Samples	$Cu(OH)_2$ (%)	$[Cu(BODN)\cdot 5H_2O]_n$ (%)	Al (%)	Nitrocellulose (%)
$[Cu(BODN)\cdot 5H_2O]_n$ arrays (5 min)	34.6	65.4	--	--
$[Cu(BODN)\cdot 5H_2O]_n$ arrays (10 min)	0	100	--	--
$[Cu(BODN)\cdot 5H_2O]_n$@nano-Al (2 drops)	--	86.2	11.7	2.1
$[Cu(BODN)\cdot 5H_2O]_n$@nano-Al (6 drops)	--	72.1	23.7	4.2