Supplementary Materials

Text S1. Sample preparation for ICP-OES

Prior to the test, an acid dissolve is performed on the brass-coated steel wire and brass sheet, and their chemical composition is quantified by measuring the ionic concentration in the acid solution. The sample in this experiment was dissolved using aqua regia (HCl : HNO_3 = 3:1), and after the sample was fully dissolved, the dissolved solution was transferred to a volumetric flask to fix the volume. The chemical composition of brass-coated steel wire and brass sheet was converted using the Eq. below.

$$C_x = \frac{C_0 \times f \times V_0 \times 10^{-3}}{m_0} \quad \text{(S1)}$$

$$w = \frac{C_x}{10^6} \times 100\% \quad \text{(S2)}$$

where, m_0 (g) is the mass of the sample to be measured, V_0 (mL) is the volume of the volumetric flask, f is the dilution multiple, C_0 (mg/L) is the measured ion concentration, C_x (mg/kg) is the ion concentration of the dissolved solution, w (%) is the chemical composition of the sample.

Text S2. Identification of dual phase structure

The identification of the dual phase structure involved in this work is a method of metallographic analysis in materials science. In the subject of metallic materials research, metallographic analysis occupies a significant position as one of the primary techniques for evaluating the internal structure and defects of alloys. Since all of the brass sheets used for this work were purchased from the same batch by the same company, there should be no difference between each of the sheets. Before taking the image, the brass sheet needs to be polished to get rid of any surface oils, cut marks, scratches, impurities, or anything else that can affect the identification of phase structure. The polished brass image in Fig. S1a clearly reveals that there are tiny shrinkage pores on the surface, but there is no dual phase structure to be detected. Therefore, the brass must be colored in order to detect the dual phase structure. The chemical coloring method also known as the chemical etching method, is used in this work. This method is an electrochemical dissolving process where the grains, grain boundaries, and phases have various physicochemical characteristics and free energies, and in the electrolyte solution, they can form microcells with various electrode potentials. The anode of the microcell, which has a lower potential, dissolves more quickly. At the site of dissolution, pits or deposited reaction products are left behind so that grain boundaries, grains, and phases can be clearly observed. In this work, the SEM image after coloring was obtained employing the HCl-$FeCl_3$ solution (5 g of $FeCl_3$, 15 mL of hydrochloric acid, 100 mL of deionized water), as exhibited in Fig. S1b. The mutually parallel rod-shaped areas (A), pitted areas (B), and irregular rectangular areas (C) are the three readily identifiable areas in the diagram. In general, mutually parallel rod-shaped structures and irregular rectangular structures are identical, with the exception that mutually parallel rod-shaped structures are typically referred to as twins. Additionally, the EDS indicates their compositions are nearly identical and that the ratio of Cu to Zn is approximately 6:4 (Fig. S1c). The composition of B (Cu and Zn in a ratio of roughly 1:1), which is completely different from them, demonstrates that the phase is distinct from A and C. In material science, the B shaped phase of brass and the A and C shaped phases are generally referred to as α (Cu3Zn2) and β (CuZn), respectively. Similar results are obtained by immersing polished brass (uncolored) in an ammonia solution for 5h, that is, the image exhibits the three shapes of the aforementioned structures.

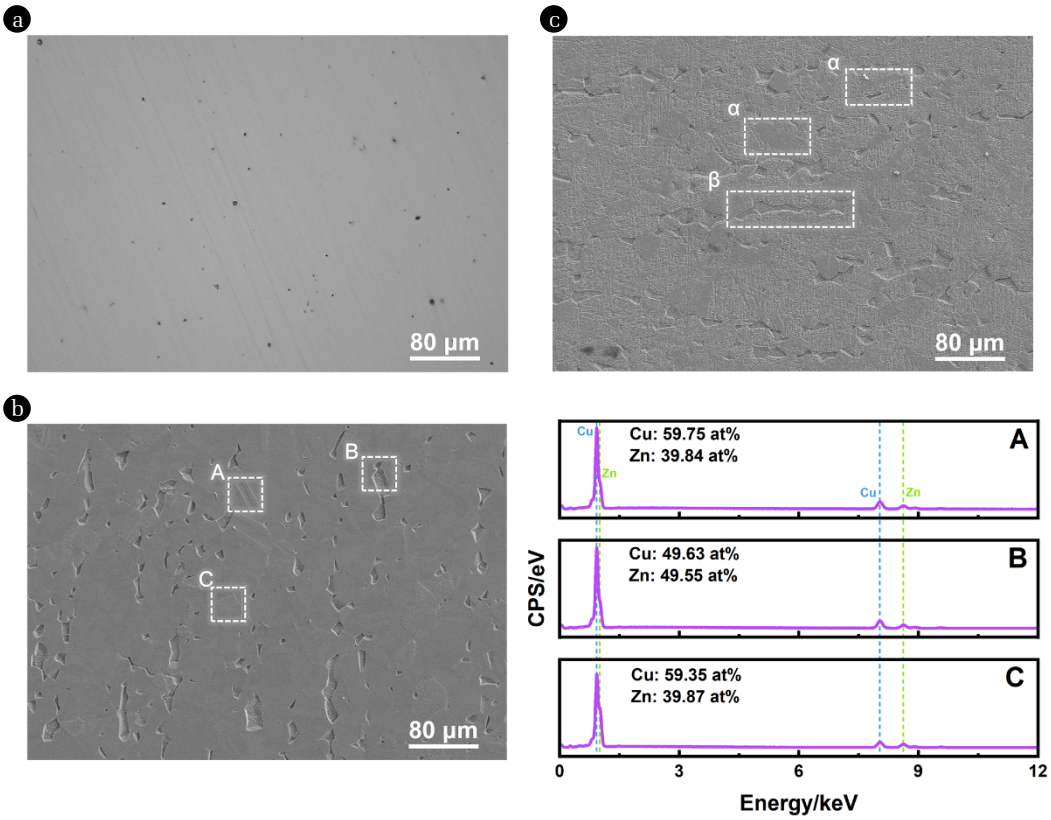

Fig. S1. (a) SEM image of H62 brass (after polishing, without colored). (b) SEM image of H62 brass and EDS patterns (after polishing and colored). (c) SEM image of polished H62 brass after ammonia corrosion (after polishing, without colored).

Fig. S2. The macroscopic images of brass-coated steel wires and corrosion solution after (a) AH corrosion, (b) after ammonia corrosion alone (20%), and (c) after hydrogen peroxide corrosion alone (10%). The corrosion time is 5 min

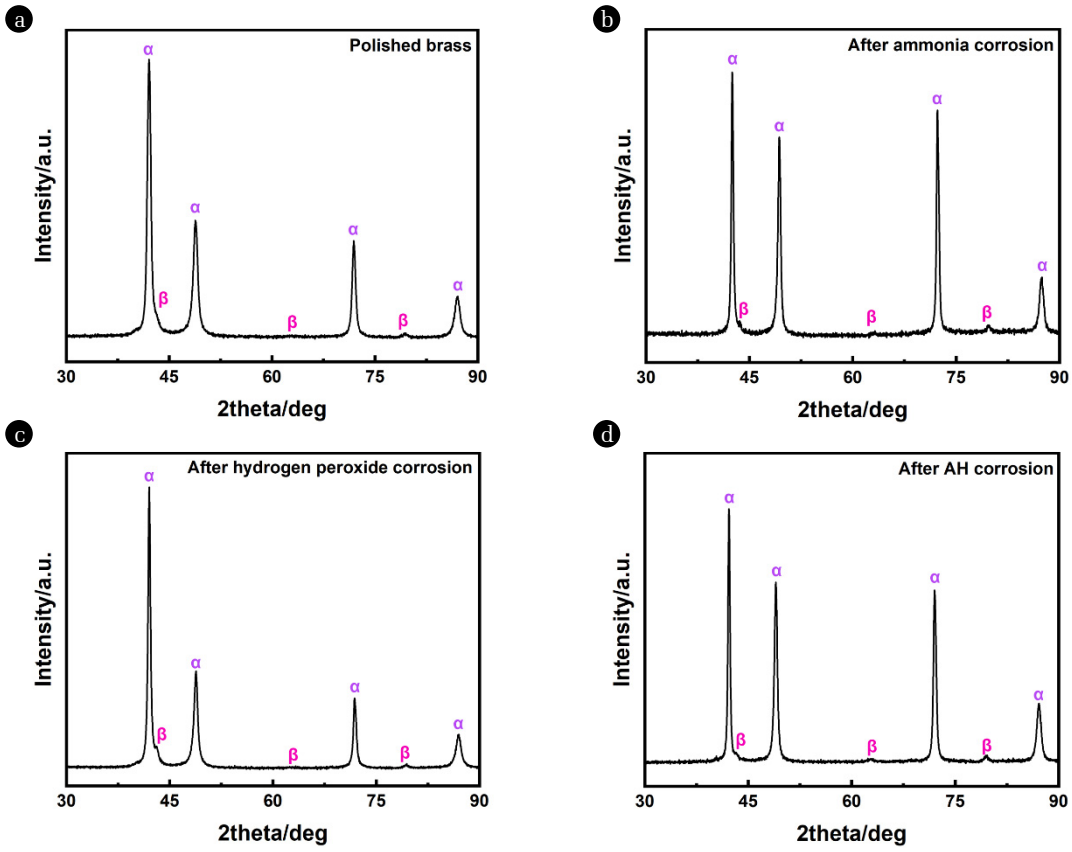

Fig. S3. XRD patterns of the brass sheet (a) after polished without corrosion, (b) after ammonia corrosion alone, (c) after hydrogen peroxide corrosion alone, and (d) after AH corrosion.

Table S1. Potentiodynamic polarization parameters measured from polarization curves of H62 brass at different corrosion solutions

Solution	$i_{corr}/10^{-5}A\cdot cm^{-2}$	R_p/ohm	$\beta_a/mv\cdot dec^{-1}$	$\beta_c/mv\cdot dec^{-1}$	$CR/mm\cdot year^{-1}$
Ammonia	6.02	293.6	5.827	-2.371	0.73
AH	12.91	112.9	4.908	-5.030	1.57

Table S2. Fitted equivalent circuit parameters for different samples at different corrosion solutions

Solution	R_1/ohm	$CPE_1/10^{-9}F$	R_2/ohm	QPE		R_3/ohm	L/Henri	R_4/ohm	CPE_2/F	R_5/ohm
				$CPE/10^{-4}S\cdot sec^n$	n					
Ammonia	26.53	6.47	94.81	10.41	0.79	39.32	4.461	20.31	0.80	35.80
AH	22.09	8.05	93.28	-	-	4.40	-	-	6.49E-4	-

Table S3. Distance between phases and adsorbates

Adsorbate	α		β (β-Zn)	
	Zn-X	Cu-X	Zn-X	Cu-X
NH_3	2.2229	Break	2.10013	Break
O- 2	1.9366	2.0051	2.0427	2.0206
OH^-	2.0335	2.0248	1.8524	Break

Table S4. Bader charge of different corrosion system

System	Atom	Charge	System	Atom	Charge
α-NH_3	Zn36	-0.2019	β-NH_3	Zn15	0.0136
	N37	-0.0349		N46	0.0262
α-O_2	Cu6	-0.2334	β-O_2	Cu41	-0.2828
	O38	0.4223		O47	0.5232
	Cu21	-0.2425		Zn15	-0.3604
	O38	0.4223		O46	0.4526
	Zn36	-0.2756		Zn18	-0.2769
	O37	0.3982		O47	0.5232
α-OH	Zn36	-0.2748	β-OH	Zn15	-0.3912
	O37	0.5660		O46	0.6148
	Cu6	-0.2188			
	O37	0.5660			

Table S5. Bader charge of different complex corrosion system

System	Atom	Charge	System	Atom	Charge
α-OH-O_2	Zn36	-0.5099	β-OH-O_2	Zn12	-0.3020
	O39(OH)	0.5920		O48(OH)	0.6077
	Cu14	-0.2047		Cu32	-0.3038
	O39(OH)	0.5920		O48(OH)	0.6077
	Zn36	-0.5099		Zn15	-0.4523
	O37(O2)	0.4633		O46(O2)	0.4599
	Cu21	-0.2284		Zn27	-0.2815
	O37(O2)	0.3287		O47(O2)	0.5258
	Cu6	-0.2058		Cu41	-0.2980
	O38(O2)	0.3063		O47(O2)	0.5258
	Cu10	-0.2077			
	O38(O2)	0.4409			