New Products

Good Deep Drawability Copper Alloy Strips EFHD

1. INTRODUCTION

Along with the performance improvement of various electronic devices such as mobile devices, electronic components characteristics are becoming higher in frequency and current, and smaller. Therefore, measures for electromagnetic compatibility (EMC), for heat and component rigidity have become particularly important. As an example, Figure 1 shows various electronic components installed in a smartphone. From the standpoint of rigidity and shielding, it is considered effective to make camera module cases, electromagnetic wave shield cases on the substrates, and connectors (the shield shell part and the hold-down part) an integral structure (drawing) with no gaps. In addition, the cases are required to have a high thermal conductivity in order to diffuse heat from the internal module. We have developed the copper alloy EFHD series, which has various strengths, electrical and thermal conductivities suitable for these applications and also can be drawn.

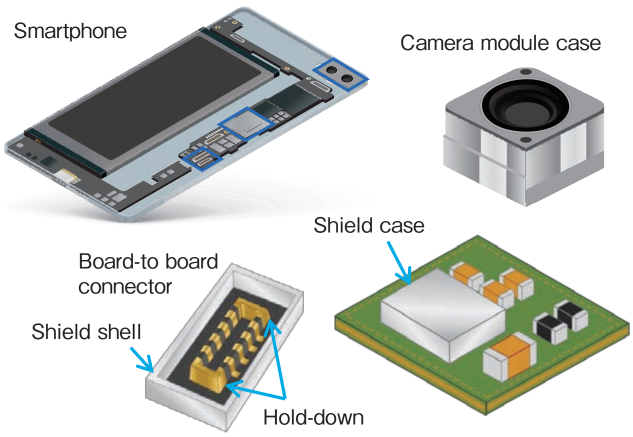


Figure 1 Application examples of the EFHD.

2. FEATURES

Table 1 shows the various properties (representative values) of the EFHD-64T, the EFHD-97 and the EFHD-98S of the EFHD series, and for comparison, also the values of C2680 (brass), C7521 (nickel silver) and SUS304, which have been applied to shield cases, and C5210 (phosphor bronze) for board-to-board connectors, and SUS305 for camera module cases are shown. The tensile strength, the elongation, and Young's modulus were measured with a tensile test, the electrical conductivity was measured with the four-terminal method, and the thermal conductivity is a value converted from the electrical conductivity according to the Wiedemann-Franz rule. We have developed three types of the EFHD series which have a wide range of balance between the strength, the conductivity and the thermal conductivity so that you can select the material that best suits your application.

Figure 2 (a) shows the appearance of cylindrical drawn products (diameter: 20 mm, corner radius: 0.5 mm) formed by one-time drawing from blanks with diameters of 30, 35, 40 and 45 mm and a thickness of 0.2 mm. The drawn products have no wrinkles or rough skin, and have a good appearance. Next, Figure 2 (b) shows the limiting drawing ratio for each material (the value obtained by dividing the blank diameter that can be processed in one-time drawing by the punch diameter: the higher the value, the better the workability). Although the drawability of the EFHD series is inferior to that of SUS304, it has almost the same performance as C7521 (nickel silver) and C2680 (brass).

In addition, Figure 3 shows the appearance of the rectangular drawn products of the EFHD series (width 15 mm, length 24 mm, height 8 mm, corner radius 0.1 mm). These are formed from two drawing processes, and can be processed into rectangular shapes.

Table 1 Material properties.

Material		Tensile strength (MPa)	Elongation (%)	Young's modulus (GPa)	Electrical Conductivity (%IACS)	Thermal conductivity (W/m/K)
New product	EFHD-64T	520	15	120	75	301
	EFHD-97	700	13	125	40	170
	EFHD-98S	800	12	127	30	120
Conventional material	C2680	400	32	103	27	117
	C5210	530	28	110	12	48
	C7521	550	20	130	6	24
	SUS304	850	45	180	2	8
	SUS305	700	50	180	2	8

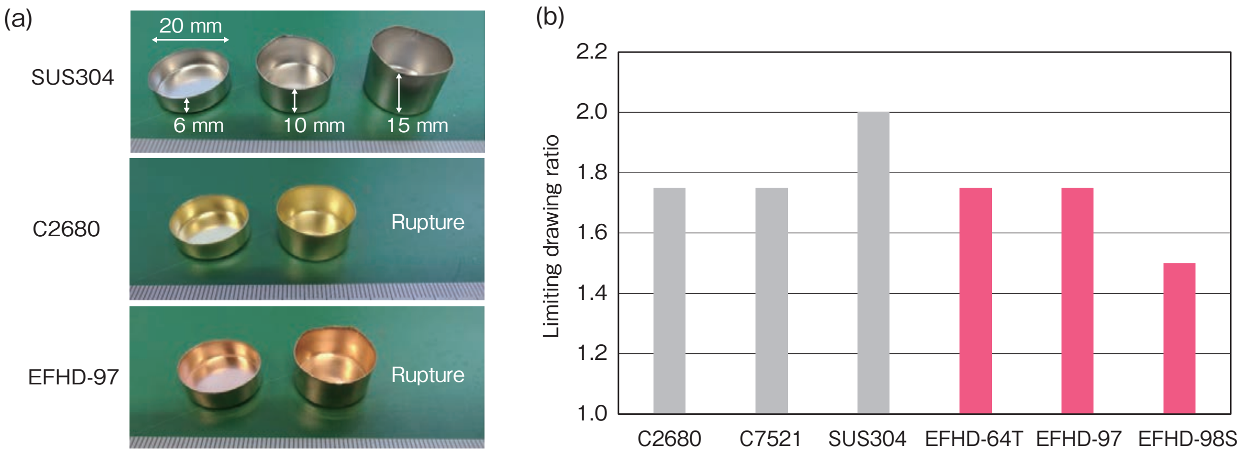


Figure 2 Drawability. (a) Appearance of the cylindrical drawn products, (b) Limiting drawing ratio.

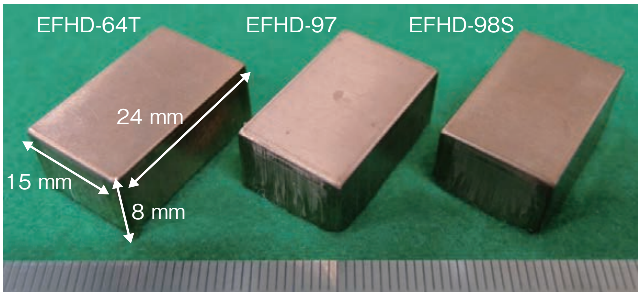
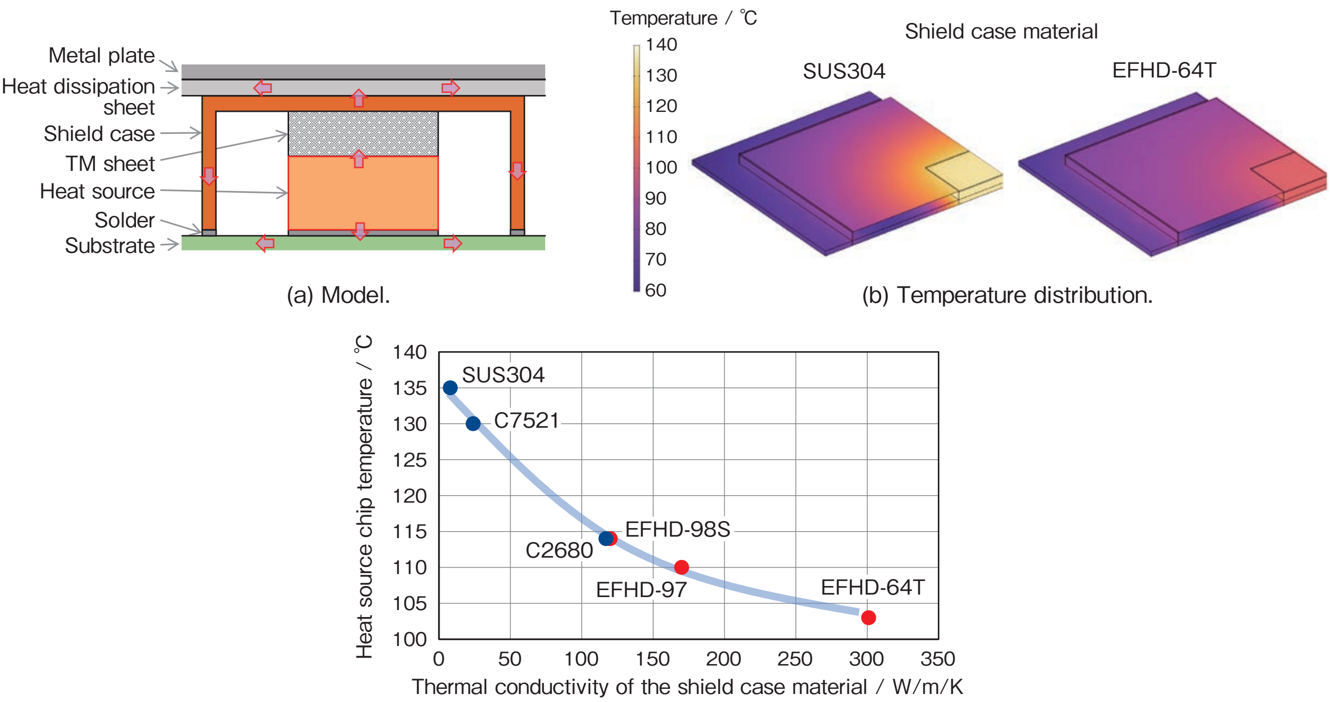


Figure 3 Appearance of the rectangular drawn products.

As described above, the EFHD series has a sufficient drawability, and has an equal or greater strength , a higher electrical conductivity and a thermal conductivity compared to conventional materials. For this reason, it can be used to the application examples such as shown in Figure 1, etc.

As an example of application, Figures 4 and 5 show the simulation results of the heat dissipation and the electromagnetic wave shielding, respectively, assuming that the EFHD is used as a shield case. In the model in Figure 4 (a) (the heat source is assumed to be a CPU with a heat generation of 4 W), the temperature distribution (1/4 model) when SUS304 (thermal conductivity 8 W/m/K) and the EFHD-64T (301 W/m/K) are used for shield case materials are shown in (b). It shows that the EFHD-64T, which has a high thermal conductivity, did not generate a heat spot, and the heat was sufficiently diffused.

Figure 4 (c) shows the relationship between the thermal conductivity of the shield case and the temperature of the heat source. When the thermal conductivity was increased from 10 - 20 W/m/K, which is the value of the conventional shield case materials such as SUS and nickel silver, to 301 W/m/K, which is the value of the EFHD-64T, the temperature of the heat source dropped from



(a) Model.

(b) Temperature distribution.

(c) Heat source temperature.

Figure 4 Heat dissipation simulation of the shield case.

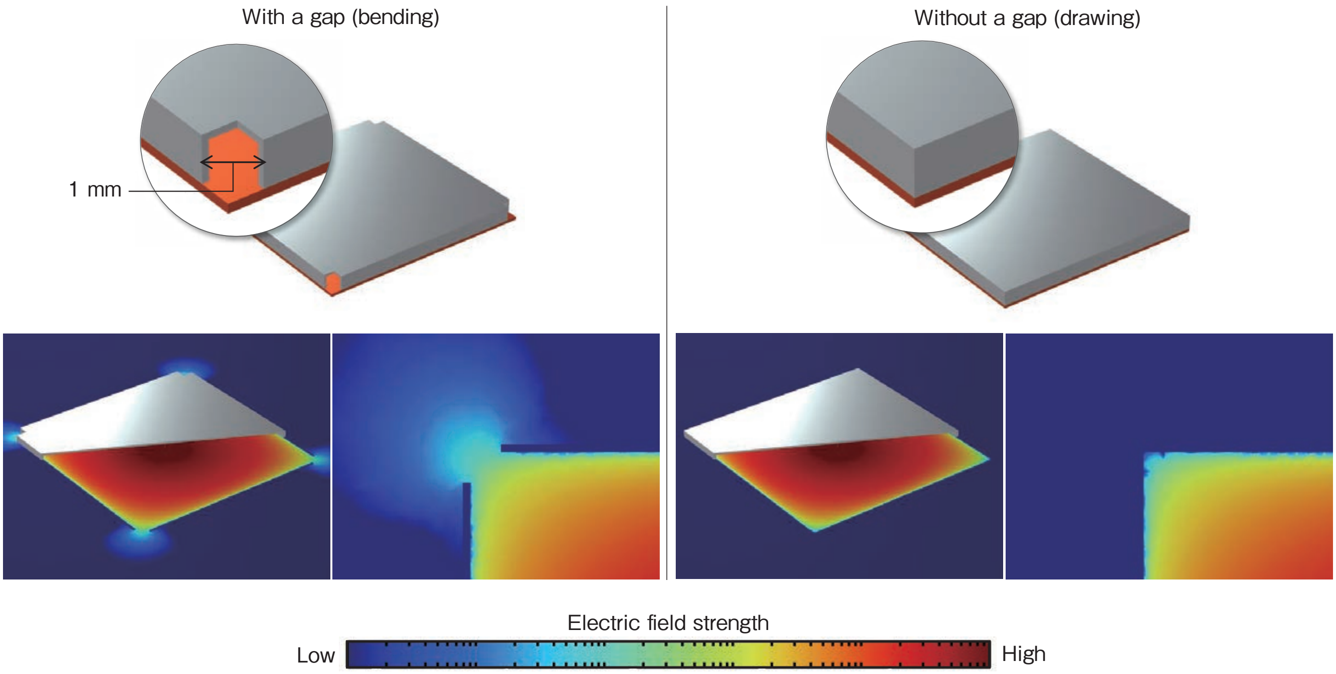


Figure 5 Electromagnetic wave shield simulation of the shield cases.

132°C to 103°C, that is, the reducing effect was Δ29°C. It is considered to be effective in maintaining a high-speed operation of CPUs. “F-CO TM Sheet” was applied between the heat source and the shield case in the model.

Figure 5 shows the results of a comparison of the electromagnetic wave shielding effect in a simulation with and without a gap, assuming bending and drawing processes. Inside the cases, a noise source that generates electromagnetic waves of 3.3 GHz, which is the frequency used in smartphones, was installed, and the electric field strength is indicated by color. When there was a gap in the case, the leakage of electromagnetic waves was also be confirmed outside, and depending on the frequency and the size of the gap, it may be necessary to take measures to close the gap. On the other hand, when there was no gap, no leakage was observed, so drawing can be said to be a suitable processing method from the standpoint of electromagnetic shielding. In addition, it is advantageous in terms of manufacturing costs because it does not require measures to close the gap.

3. CONCLUSION

The EFHD series developed by our company has a lineup from the high electrical conductivity (high thermal conductivity) type to the high strength type suitable to be used in a variety of applications. We propose that by using it for various applications such as camera modules, shield cases, board-to-board connector shield shells and hold-downs, it contributes to the mitigations against EMC and heat dissipation, and to the improvement of the rigidity.

For more information, please contact:
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F-CO TM Sheet
Furukawa Electric Power Systems Co., Ltd.
Contact form:
https://www.feps.co.jp/cgi-bin/inquiry.cgi?id=feps_en
Product information:
https://www.feps.co.jp/english/products/fco/fco_tm.htm