

High Conductive and High Strength Copper Alloy Wire FWUHD-XT for Smart Devices

1. INTRODUCTION

As electronic devices are becoming more multi-functional and wearable, demand for smaller and lighter parts is increasing. In addition, electric wires for equipment wiring are required high conductivity from the perspective of the increase in the current and the increase in efficiency for energy saving. On the other hand, ultra-thin diameter cables and coils used in small devices need to be durable against bending and vibration. In particular, robot cables, whose demand has been increasing in recent years, must have a high flexural-fatigue resistance and a high twist characteristic. Therefore, we have developed the FWUHD-XT series, which has an extremely excellent balance of the electrical and the mechanical characteristics as a copper alloy wire. As this product has both the high conductivity and the high strength, it can be used in a wide range of fields such as wearable devices, electronic device connection cables and medical cables.

2. FEATURES

As the FWUHD-XT series uses our unique casting process and microstructural control process, it is superior to general-purpose copper alloy wires and common Cu-Ag alloy wires currently on the market with respect to the following points: (1) Achievement of the high electrical conductivity and the high tensile strength at the same time, (2) flexural-fatigue resistance, and (3) wire drawability.

(1) Achievement of the high electrical conductivity and the high tensile strength at the same time

Table 1 shows various typical characteristics. In addition, Figure 1 shows a comparison of the relationship between the electrical conductivity and the tensile strength with those of a typical copper alloy wire. This product has achieved an improvement in strength of approximately 350 to 550 MPa compared to a general-purpose alloy with the same conductivity. This wire has a superior electrical conductivity and a tensile strength compared to a common Cu-Ag alloy wire (FWUHD-Ag series) that we have been manufacturing.

Table 1 Material properties.

		FWUHD-XT	
		20XT	40XT
Tensile strength	MPa	1,100	1,400
Electrical Conductivity	%IACS	82	72
Thermal conductivity	W/m·K	320	290
Young's Modulus	GPa	125	
Specific gravity	—	8.9	

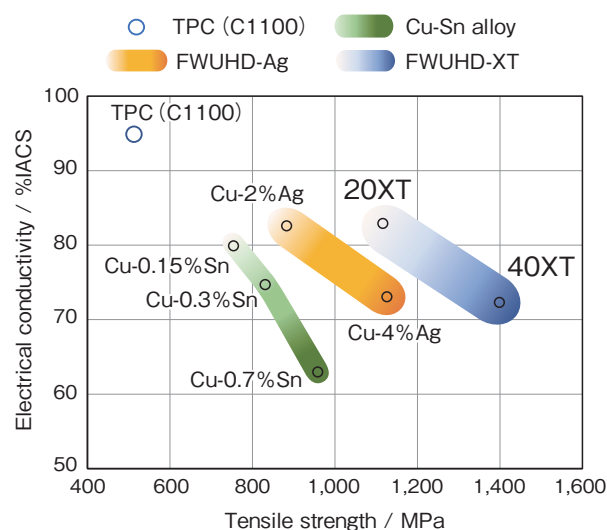


Figure 1 Relationship between the electrical conductivity and the tensile strength of various copper alloy wires.

(2) Flexural-fatigue resistance

Figure 2 shows the evaluation method of the flexural fatigue. Figure 3 shows a comparison of the flexural fatigue resistance. The FWUHD-XT series exhibited a flexural life that is approximately two to three times longer than common Cu-Ag alloys of the same composition, which has an excellent durability against repeated bending and vibration. For example, the FWUHD-XT series can achieve a mechanical strength and a flexural fatigue life equivalent to or higher than those of Cu-4%Ag alloy wires which are obtained using conventional processes, but with a smaller amount of added Ag. Therefore, it is possible to improve conductivity while maintaining conventional strength, and to reduce the amount of expensive Ag used.

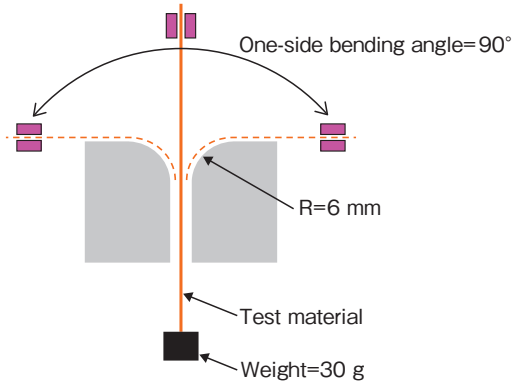


Figure 2 Evaluation method of a flexural fatigue life.

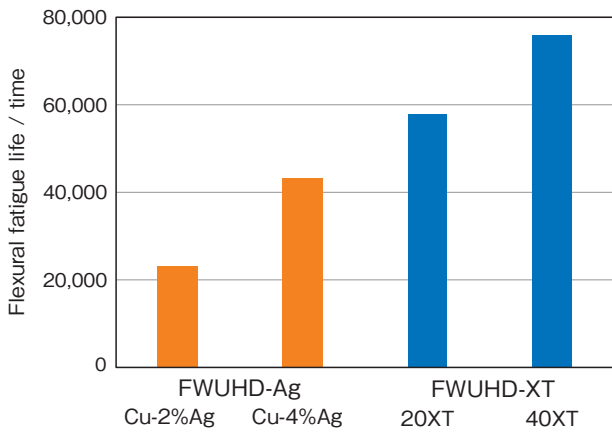


Figure 3 Comparison of the flexural fatigue life between the FWUHD-XT and common Cu-Ag wires.

(3) Wire drawability

This series has an excellent wire drawability and can be processed into ultra-fine wires of $\phi 50 \mu\text{m}$ or less. Our melting and casting, and processing technology, which takes active measures to remove foreign substances, reduces the amount of foreign substances contained in alloy wires by approximately 60% compared to general processes, significantly reducing the risk of property deterioration and wire breakage during ultra-fine diameter wire drawing.

3. CONCLUSION

The FWUHD-XT series is a Cu-Ag alloy wire that has a balance between the conductivity and the tensile strength at a higher level with our unique manufacturing process. Due to its characteristics and good workability, it contributes to the miniaturization and multi-performance of various transmission cables, robot cables, etc., and is expected to be used in high-performance electronic devices.

For more information, please contact:

Electric Conductor Division

E-mail: fec.doudenzai@furukawaelectric.com