» New Products

Heat-Resistance Low-Insertion Force Cu-Sn Plated Strip

1. INTRODUCTION

In recent years, the multipolarization and the downsizing of the connector terminals for automotive wire harnesses have been advancing to cope with an increase in the number of in-vehicle electronic devices and wiring. In addition, their uses in high temperature environments, such as in the vicinity of engine rooms, are increasing. Therefore, the plating materials of the connector terminals require both a low insertion force, which enables their application in a multipolarized condition, and a connection reliability in a high temperature environment.

We have developed a heat resistance and a plated strip with a low insertion force for connector terminals to satisfy the needs stated above.

2. CHARACTERISTICS

Figure 1 shows the basic construction of this plating. Both a low contact resistance, which is equivalent to the existing plating, and a low insertion force have been achieved in this plating by forming an intermetallic compound layer, which consists of Cu and Sn, in the surface layer.

1) A Low insertion force
   The insertion force is reduced by about 20% compared to the existing tin plating with the low insertion force by forming a solid Cu-Sn intermetallic compound layer on the surface.
2) A Restraint of the rise in a contact resistance caused by the fretting corrosion
   The rise in a contact resistance caused by the fretting corrosion is restrained because the Cu-Sn intermetallic compounds on the surface is resistant to wear.
3) A High heat resistance
   The Ni layer, which is a diffusion barrier for preventing the continuous diffusion of Cu from the base material, restrains the deterioration of the electrical connection in a high temperature environment.
4) An Anti-whisker property
   The generation of whisker, which causes a trouble when applying the Sn plating, is restrained because the surface layer is a Cu-Sn intermetallic compound layer.

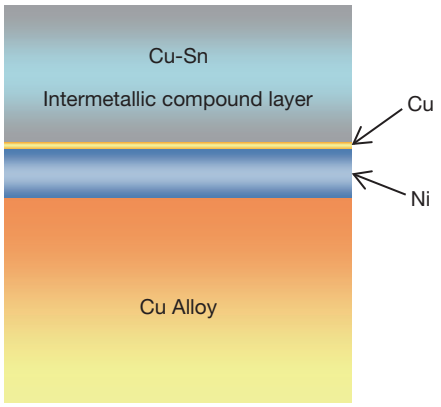

Figure 1 Plating structure.

3. A LOW INSERTION FORCE

Figure 2 shows the coefficient of the dynamic friction and the insertion force when this plating is applied to the connector terminal for automotive wire harnesses (the width of the male tab is 2.3 mm).

Compared to the existing tin plating with the low insertion force, the coefficients of the dynamic friction and of the insertion force are reduced by 20%.

4. A RESTRAINT OF A RISE IN THE CONTACT RESISTANCE CAUSED BY THE FRETTING CORROSION

A rise in the contact resistance by the fretting corrosion, which causes a problem with the connector terminals for automotive wire harnesses, is restrained.

＊Rise in a contact resistance by the fretting corrosion

It is a well-known fact that when a contact part of the terminals slides in a very small amplitude by the oscillation of an automobile, the Sn plating layer is shaved and an abrasion dust is generated. It is called the fretting wear: When the generated abrasion dust is oxidized and is stuck in a contact part as an insulator, the contact resistance value between the terminals rises. It causes a contact failure in a shorter time compared to its estimated original life.

In recent years, many connectors are designed to lower the contact pressure between a male and a female terminals for the purpose of lowering the insertion force of a connector. It is a cause of the rise in a contact resistance by the fretting corrosion.

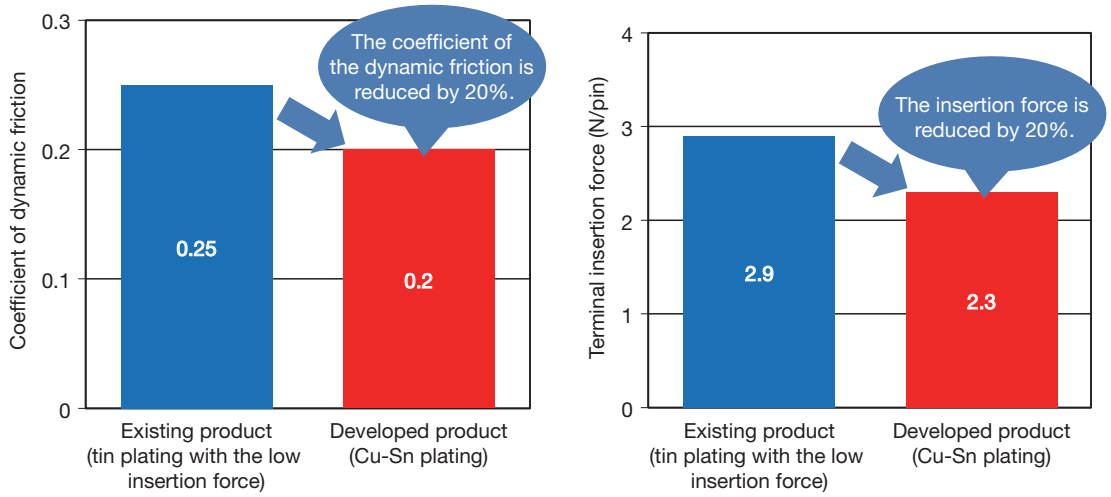

Figure 2 Coefficients of the dynamic friction and of the insertion force.

In this plating, the generation of an abrasion dust, which causes a rise in a contact pressure, is minor because the intermetallic compound layer on the surface is not easy to wear, thereby shows a stable contact resistance value.

Figure 3 shows the result of the fretting test.

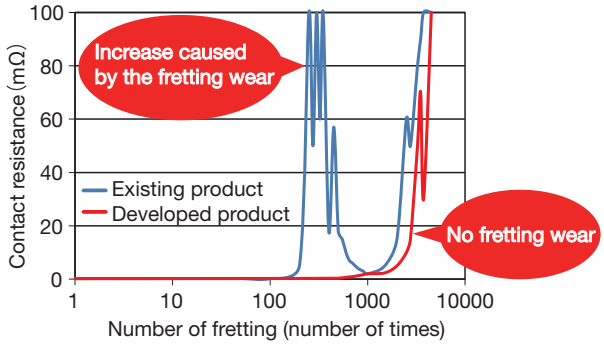

Figure 3 Result of the fretting test.

5. AN ENVIRONMENT RESISTANCE

Table 1 shows the results of the environmental tests.

Table 1 Heat resistance and corrosion resistance

Evaluation item		Company standard	Evaluation result
Heat resistance	Contact resistance (R_c)	After heating at 160℃ for 120 hr, $R_c < 10$m Ω	< 2.5 mΩ
	Peel testing	After heating at 140, 160, 180℃ for 120 hr, no peeling	No peeling
Corrosion resistance	Salt spray testing	35℃, 5% NaCl aq After testing for 96hr, no verdigris	No verdigris
	Gaseous corrosion testing	40℃, 85%RH, 1 ppm SO_2, After testing for 240 hr, $R_c < 10$ mΩ	< 5.0 mΩ

6. CONCLUSION

The insertion force of the connector terminals for automotive wire harnesses can be lowered by using this plating. In addition, this plating enables further low contact pressure designs of connector terminals by taking advantage of its feature to be able to restrain a rise in the contact resistance by the fretting corrosion. In this way, this plating contributes to the multipolarization and the downsizing of connector terminals.

In addition, we can provide the most suitable materials which meet our customers' needs by the total manufacturing from the base material to the plating with our manufacturing technology accumulated over a long time.

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