Exceptional position of ZnNi alloy plating for automotive engineering

By Rainer Venz, COVENTYA GmbH

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In today's automotive industry, warranty periods are now very long, especially for non-perforation corrosion. The requirements of corrosion protection layers have constantly increased to fulfil this demand. In addition to protection against atmospheric corrosion additional performances are also demanded such as temperature resistance, consistent coefficient of friction, electrical conductivity, and even more homogeneous appearance.

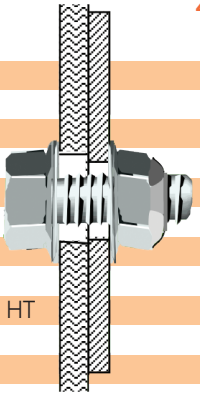
Quality of the layer

The higher the requirements for ZnNi surfaces the more complex process management and quality control of the layer are required. State of the art, automated analysing and dosing equipment is essential; as well as cooling, heating and filtration units. Laboratories must also be equipped with modern analytical capabilities, like atomic absorption spectroscopy (AAS), and have qualified specialists to operate them.

Corrosion protection

ZnNi coatings can reliably reach the corrosion protection targets defined by DIN EN ISO 9227 (neutral salt spray test), which meets major automotive OEM specifications. In fact substrate corrosion protection is much higher than the requirements in the standards. To simulate more complex corrosion stresses, however, alternative climate test methods are increasingly being utilised.

Coupled substrate →		Zinc	Zinc Nickel 12-15%
Stainless	Z 10 Cr Ni 18-9	1270	970
Brass	Cu Zn 39 Pb	760	460
Tin		600	300
Al 2017	Al Cu 4 Mg	460	160
Cast Iron		460	150
Steel	XC 10	400	100
Al 2011	Al Cu 5 Pb Bi	400	100
Al 6060	Al Si 10 Mg	335	35
Steel	XC 80 XC 90 with HT	305	5
Al 5754	Al Mg 3	300	0
7049	Al Zn 8 Mg Cu	175	-125
Magnesium		-660	-860



Combining different materials in vehicle – especially light metals to deliver weight reduction – can, depending on the material combination, cause galvanic corrosion. Avoiding galvanic corrosion or reducing the risk of it, is one advantage of ZnNi, particularly in combination with aluminium substrates.

Friction behaviour

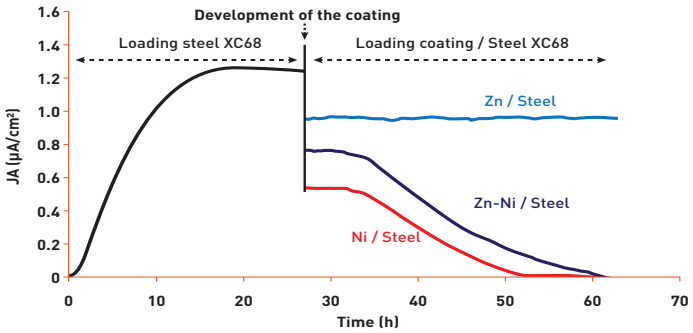
An addition sealant can be applied on top of passivated ZnNi layers and integrated lubricants can be used to ensure uniform friction values. Depending on the type and quantity used of the various waxes, different target values can be achieved. A range of different FINIGARD topcoats is available to fulfil typical OEM friction requirements.

Appearance

For design reasons, many fasteners or other functional parts need, in addition to achieving defined technical performance, to present a uniform silver or black appearance. In a few cases, in order to differentiate parts that may look very similar, it is necessary to introduce a third colour. In such cases yellow iridescent passivates may be used. All of these variations are based on trivalent chromium technologies that fulfil ELV requirements.

Substrates

The use of ZnNi can also successfully contribute to construction design objectives. The need to reduce weight results in increased use of high-strength steel, which permits components to be made smaller while maintaining comparable mechanical performance. High strength steel, however, is susceptible to delayed fractures due to hydrogen embrittlement. Here, electrolytic application of ZnNi coating can provide clear benefits.



Scientific investigations have proven there is no risk of delayed hydrogen-induced embrittlement fractures in materials of strength grade 10.9, as long as all the technical rules for the ZnNi plating process and preparation are respected. The industry is currently collecting practical experience in different field trials.

Conclusion

ZnNi technology provides a combination of many positive properties, which mean ZnNi coated parts and fasteners can be used in an extensive range of automotive applications. ■

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