

The Use of Copper Alloy Horseshoes

This paper accompanies Esco Buff's presentation "Various Uses Of Copper Alloy Horseshoes"

By Esco Buff, PhD, APF, CF

Copper is an essential mineral and element in our everyday lives. Man has been using it longer than any other metal, dating back more than 10,000 years — including a pendant that was discovered in what's now northern Iraq and forged in the year 8700 B.C.

It's a major industrial metal because of its high ductility (able to be hammered thin), malleability (able to be shaped and rolled), thermal and electrical conductivity (heat and electricity transfers at a higher rate) and resistance to corrosion. It's an essential nutrient in our daily diet. Its antimicrobial properties are becoming increasingly important to the prevention of infection.

I first started forging pure copper for horseshoes in the late 1970s to use for horses used to pull wedding parties.

The look of a black hoof with copper shoes and nails is regal. The copper shoes would not last much longer than a few weeks, therefore we had to apply them shortly before the wedding.

In its pure form, copper is not obviously suited for everyday use as a horseshoe; however, it's easily alloyed with other metals. This alloying with other metals gives the copper strength, wear resistance, hardness, antimicrobial, thermal conductivity and corrosion resistance making it ideal to use as a therapeutic horseshoe.

Shaping Copper Alloy Shoes

Copper alloy horseshoes generally are just a few ounces heavier than a steel horseshoe of the same size and dimensions. This is because of the alloys mixed with the copper.

Copper alloy horseshoes can be shaped cold and hot. When shaped cold,

they work like steel shoes but with a bit more spring when hit with your shaping hammer. When shaped hot, my farrier practice found the copper alloy shoes easily handle 1,100 degrees Fahrenheit (593 degrees Celsius), as determined by Tempilstik (**Figure 1**), working temperatures and held together without any issues or break down of the metal. We found this temperature good for shaping, forging and drawing clips. Lower temperatures are fine for shaping and some forging (**Figures 2-4**).

Copper alloy horseshoes produce a force transmission of a lesser magnitude than that of steel horseshoes. There is a slight attenuation of the magnitude of the force as well. What this means is copper alloy horseshoes reduce the impact of vibrations, about 8.53%, according to Dr. Eng. Alejandro Gutiérrez S. of the Department of Mechanical Engineering at the



Figure 1

Tempilstiks were used to determine the correct forging temperature.



Figure 2

A Kawell copper alloy horseshoe is heated to 1,100 degrees Fahrenheit (593 degrees Celsius).



Figure 4

Compare a cooled-down Kawell copper alloy horseshoe (left) to a non-heated Kawell copper alloy horseshoe (right).



Figure 3

A clip that was drawn on a Kawell copper alloy horseshoe.

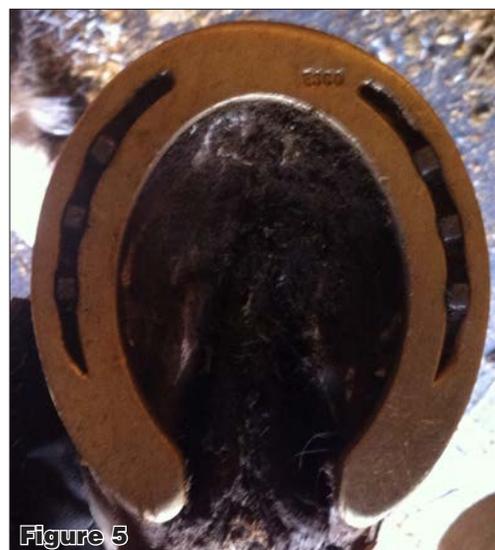


Figure 5

A Kawell horseshoe that was reset 6 weeks after its first application.

University of Santiago, Chile.

Copper alloy horseshoes, when worn out, are a recyclable material.

From personal experience, copper alloy horseshoes seems to wear someplace between aluminum and steel horseshoes depending on use (Figures 5-8).

Copper alloy shoes can be brazed or welded just like steel. Steel can be brazed/welded into the copper alloy horseshoes, as well as copper alloy into steel horseshoes (Figures 9 and 10).

Antimicrobial Properties

Copper and copper alloys commonly can be found in hospitals to minimize the spread of bacterial and fungal diseases.

The U.S. Environmental Protection Agency (EPA) has acknowledged and tested more than 350 copper alloys. Copper is the only metal that has been certified by the EPA for its antimicrobial properties. Laboratory testing has shown that copper alloy has continuous and ongoing antibacterial action killing greater than 99.9% of bacteria within 2 hours.

Initial studies at the University of Southampton, United Kingdom, and tests subsequently performed at ATS-Labs in Eagan, Minn., for the EPA show that copper alloys containing 65% or more copper are effective against methicillin-resistant staphylococcus aureus (MRSA), staphylococcus aureus, cancomycin-resistant enterococcus faecalis (VRE), enterobacter aerogenes, Escherichia coli O157:H7, and pseudomonas aeruginosa.

These bacteria are considered to be representative of the most dangerous pathogens capable of causing severe and often fatal infections.

In order for a copper alloy horseshoe company to make any claims about their product killing bacteria, they must have been tested and undergone registration with the EPA. To date, I'm only aware of one horseshoe company — Kawell — that is EPA registered. This means Kawell can claim that their horseshoes have a 99% effectiveness against killing bacteria that comes in contact with the horseshoe. I personally have seen these shoes work as claimed



Figure 6

Little wear has taken place at the toe of a Kawell copper alloy horseshoes after 6 weeks.



Figure 7

A Kawell copper alloy horseshoe after its second reset, 13 weeks after its first application.



Figure 8

The toe wear of a Kawell copper alloy horseshoe after 13 weeks of its first application and at its second reset.



Figure 9

A copper alloy frog plate that was brazed into a steel St. Croix X-ES horseshoe.



Figure 10

A copper alloy frog plate that was brazed into a Kawell copper alloy horseshoe.

(Figure 11).

A second way bacteria are killed from copper alloy EPA-approved horseshoes is through a process of a galvanic reaction between two dissimilar metals, the copper in the horseshoe and the steel nails. This galvanic reaction generates copper salts that are leached out onto the sole of the hoof. The leaching of copper salts makes an inhospitable environment for bacteria and fungi to live in. This is why you would not want to use copper horseshoe nails, as this reaction would not be produced (Figures 12 and 13).



Figure 11

The bottom of a copper alloy horseshoe after its first application 6 weeks earlier. Note the discoloration due to continuous and ongoing antibacterial actions.



Figure 12

Note the galvanic reaction that generates copper salts, which leached out on to the sole of the hoof. This leaching of copper salts makes an inhospitable environment for bacteria and fungi to live in.

Any horse with bacterial or fungal hoof, sole and frog infections can benefit from the use of EPA-approved copper alloy horseshoes. Habitual seedy toes, canker cases after debridement and with a brazed or welded-in copper alloy frog plate, and thrush cases all benefit from the contact of the copper alloy shoes and the galvanic reaction. Owner compliance in treating infections can be a challenge and the use of a copper alloy shoe ensures constant antibacterial treatment.

I have been highly impressed with Kawell's copper alloy horseshoes



Figure 13

A close-up look of the galvanic reaction and leaching of copper salts onto the sole.

because of their strength, wear resistance, antimicrobial properties and corrosion resistance (Figure 14). Ω

References

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Figure 14

Front and hind patterns of Kawell copper alloy horseshoes.

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