Copper is man's oldest metal, dating back more than 10,000 years. A copper pendant discovered in what is now northern Iraq goes back to about 8700 B.C. Copper is a mineral and an element essential to our everyday lives. It's a major industrial metal because of its high ductility (able to be hammered out 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 is 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 back in the late 1970's to use for horse's being used to pull wedding parties. The look of a black hoof with copper shoes and nails looked regal. The copper shoes would not last much longer then two weeks therefore we had to apply them the day before or day of the wedding. Copper in its pure form is not obviously suited for everyday use as a horseshoe, however it is 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.

Copper alloy horseshoes are generally just a little heavier (a few ounces) then a steel horseshoe of the same size and dimensions. This is due to the alloys mixed with the copper.

Copper alloy horseshoes can be cold and hot shaped. When shaped cold, they work like steel shoes but with a bit more spring when hit with your shaping hammer. When shaped hot, we found the copper alloy shoes easily handle 1100F (as determined by Tempilstik's) 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.

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% from one study (see study - MODELING A HORSE'S GAIT, Dr. Eng. Alejandro Gutiérrez S., Dept. of Mechanical Engineering, University of Santiago of 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.
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. Photo 13-14.

Copper and copper alloys have been used for thousands of years to kill bacteria and can commonly be found in hospitals to minimize the spread of bacterial and fungal diseases. The U.S. Environmental Protection Agency (EPA) has acknowledged and tested over 350 copper alloys. Copper is the only metal whose antimicrobial properties have been certified by the EPA. 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, UK, and tests subsequently performed at ATS-Labs in Eagan, Minnesota, for the EPA show that copper alloys containing 65% or more copper are effective against: Methicillin-resistant *Staphylococcus aureus* (MRSA), *Staphylococcus aureus*, Vancomycin-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 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. Photo 15.

A second way bacteria is 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. Photo 16-17.

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 insures constant antibacterial treatment.

I have been highly impressed with Kawell's copper alloy horseshoes due to their strength, wear resistance, antimicrobial properties, and corrosion resistance. Photo 18.
References

BERRÍOS, A; MARTÍNEZ, R; PEREDO, A; BAEZA, E. Errores técnicos en el herraje de equinos fina sangre chilenos en la provincial de Ñuble, Chile. Avances en Ciencias Veterinarias. 1995; 10(1).

RIVAS, P; ACUÑA, M; FIGUEROA, A; TRONCOSO, M; RUIZ, M; FIGUEROA, G. Estudio de la Actividad Antimicrobiana de Herraduras de Cobre en la Patología Infecciosa del Casco del Caballo (Antibacterial Activity in Copper Horseshoes). XXV Congreso Chileno de Microbiología, 2003 Nov 24-28, Antofagasta, Chile.

Comparative Analysis of the Behavior of Copper alloy and Iron Horseshoes, Research and Testing of Materials Institute (IDIEM in Spanish) of the Faculty of Physical and Mathematics Sciences, of the University of Chile.

Copper Development Association, Inc (CDA), www.copper.org


Kawell USA Product Booklet, www.kawellusa.com

MODELING A HORSE’S GAIT, Dr. Eng. Alejandro Gutiérrez S., Dept. of Mechanical Engineering, University of Santiago of Chile

Proper Use and Care of Antimicrobial Copper Alloys (Updated August 2012), Copper Development Association, Inc.
Photo 1 - pure copper stock

Photo 2 - pure copper stock in forge
Photo 3 - pure copper stock flattened and ready to shape into a horseshoe

Photo 4 - pure copper hind shoe
Photo 5 - Tempilstik’s used to get correct forging temperature
Photo 6 - A Kawell copper alloy horseshoe heated up to 1100F for forging.

Photo 7 - A clip drawn on a Kawell copper alloy horseshoe.
Photo 8 - A cooled down Kawell copper alloy horseshoe (left) as compared to a non-heated Kawell copper alloy horseshoe (right).
Photo 9 - At time of reset 6 weeks after first applying.
Photo 10 - Note little toe wear at 6 weeks on horse.
Photo 11 - After second reset 13 weeks after first applied.

Photo 12 - Note toe wear after 13 weeks after first applied and at second reset.
Photo 13 - Copper alloy frog plate brazed into a steel St. Croix X-EZ horseshoe.
Photo 14 - Copper alloy frog plate brazed into a Kawell copper alloy horseshoe.
Photo 15 - The bottom of a copper alloy horseshoe after 6 weeks from when applied on the hoof. Note discoloration due to continuous and ongoing antibacterial actions.
Photo 16 - Note galvanic reaction that generates copper salts that are leached out onto the sole of the hoof. This leaching of copper salts makes an inhospitable environment for bacteria and fungi to live in.

Photo 17 - Close up of the galvanic reaction and leaching of copper salts onto the sole.
Photo 18 - Some front and hind patterns of Kawell copper alloy horseshoes.