Raw Materials

A Closer Look at the Biggest Cost Component in the Manufacture of Brake Linings

One of a fleet maintenance manager's most critical evaluations is which brake lining is the right fit for their fleet. In an economy where bringing costs down is more important than ever, it can be difficult to justify spending more for a premium grade brake lining, such as Marathon's HeatStar. But does the money saved at time of purchase really extend through the life of the lining? That's where the rubber meets the road.

To truly understand how to assess and compare the quality/value of a brake lining, we have to look to its formulation. In other words, examine the raw materials used in the friction formula. What is a lining made of, exactly? As it turns out, not all linings are created equal.

The science behind what raw materials and in what percentages each go into a friction product is so critical to the performance of the lining that, for most companies, these formulas are closely guarded secrets. Finding the perfect balance between a lining's strength, durability, heat resistance, brake fade and, of course, cost requires extensive testing, in the lab, on the test track and on the highway.

A common misconception in the heavy-duty industry is that the price of a friction material is largely a function of the labor rate in the country of manufacture. In reality, labor is typically less than 35% of the cost of the product, whereas the raw materials used in the friction formula represent more than 65% of the cost. Further, labor savings that might occur in far East countries are usually offset by freight costs and lead-times to deliver to North America.

A Closer Look at Raw Materials

One of the stars of any friction material is phenolic resin. Used as a binding agent, this raw material is cured through a high-heat, thermoset reaction. As a result, linings that have higher amounts of phenolic resin maintain strength and integrity over time. Phenolic resin also helps improve lining wear/life at low temperatures, making it key for over-the-highway applications.

Two other vital raw materials are chopped fiberglass strand and abrasives (aluminum oxide). Fiberglass increases the flexural strength of a friction material, effectively minimizing cracking because of its ability to reinforce and strengthen. Abrasives like aluminum oxide are the raw materials responsible for creating the torque when brake linings are used during a stop – quite literally, the friction.

Graphite is also an important raw material, as it is temperature resistant and acts as a lubricant for the lining, thus greatly aiding in reducing wear and stabilizing friction level. Because different types of graphite exhibit varied frictional characteristics, many combinations or forms of graphite may be used in a friction formula based on the application of the lining.

Rubber and friction particle, along with graphite, are part of a second tier of raw materials from an importance/cost perspective. Rubber, typically recycled tire treads, and friction particle derived from cashew shells are both organic materials that help to make the friction softer and more compressible.

Other inorganic minerals such as calcium carbonate, barytes, and wollastonite, commonly referred to as fillers, are mined directly from the earth and as a result are generally inexpensive. But because these ingredients are naturally sourced, they require purification processes before being considered acceptable for a friction material. However, it can be costly to set up and maintain high quality separation and purity processes. Outsourced manufacturing companies in the far East often forgo first-rate purification standards as a method to reduce costs. These impurities can lead to issues with lining and drum wear or noise.

So, how does the use of raw materials and the ultimate price of a brake lining come in to play? As previously noted, the cost of labor in friction manufacturing is actually dwarfed by the much larger cost of raw materials. An excellent way to illustrate the impact of raw materials is to look at the varying costs of friction materials from a single manufacturer, like Marathon Brake Systems.

Marathon's premium grade linings such as HeatStar cost approximately twice as much as their economy grade linings. With both brake linings manufactured in the same plant with the same labor cost, the difference in price is almost entirely driven by the raw materials used in the friction formulations. A higher percentage of the key and very expensive tier one raw materials of phenolic resin, fiberglass and aluminum oxide will be found in HeatStar and a lower percentage of the less expensive filler materials. The opposite is true for economy grade materials.

The same principle holds for the low cost linings manufactured in the far East. Lower percentages of key raw materials combined with a lower quality of these raw materials results in a less expensive product… and one that performs poorly in most key metrics. This leads to more frequent brake jobs and issues like friction cracking, which can cause out-of-service fines and safety concerns such as wheel lockup and fires.

More fleets are learning what friction manufacturers have known for years – you get what you pay for. To achieve the greatest return on investment, a premium lining manufactured with the best raw materials will save fleet owners significant money by delivering a longer service life with superior performance characteristics, thereby extending brake reline cycles. Giving you confidence in your fleet's safety and improving your bottom line.