

MAGAZINE

APRIL 2008

Jobber News

Serving the Automotive Aftermarket for 75 Years

Canada Post Canadian Publications Mail Sales Agreement No. 40069240

CREEP GROAN

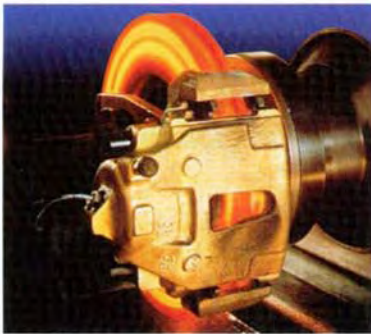
The Dark Art of Brake Friction Science
And The New Push For Standards

Planar Oxygen Sensors Explained
Light Truck Accessories Market
The Rise of Diesel Performance
Down and Dirty with the ATV Market

CREEP GR

The Dark Art of Brake Friction And The New Push For Standards

by Andrew Ross



While the topic of what brake pads are made of may seem like an esoteric discussion, in reality it is at the root of the most important issues affecting the segment for everyone involved in their distribution, sale, and installation.

Beyond fit, form, and function, friction formulation and brake construction are inexorably linked to driver and worker safety, health, and the environment at large. And developments in the global marketplace have spurred a new push for aftermarket brake standards.

The fact is that brake manufacturing, for all its engineering, remains a dark art, shrouded in more than a little secrecy.

Few of those on the inside of the brake manufacturing world will talk in specific terms about what components they use to achieve the formulation they deem to be best for the stated goal. There are good competitive reasons for this, and the fact is that the subtle science of friction is tough to explain (one technical paper on low speed brake noise provided the inspiration for this article's title). What they will talk about, however, is the reasons behind the significant engineering that goes into a quality brake friction product.

Ian Braunstein, vice-president, sales for Satisfied Brake Products, based in Cornwall, Ont., says that there are a few key

elements the aftermarket should consider.

Consumers want a brake that performs well and quietly; the installer never wants to do a brake job over. And, of course, the distribution chain is concerned about pricing.

"NVH—noise, vibration, and harshness—is ultimately what sends

the consumer back to the garage. To avoid that rejection, you have to be more relevant [to the application], and be much more specific."

He points out that the game is changing all the time.

"The evolution continues because the customer's expectation is rising. He doesn't want to hear a howl and scream. He wants no noise, but now the dust on his wheels is driving him crazy. The customer is having a higher expectation when you are in the premium zone."

New approaches such as the ceramic friction category of materials are a direct result of this; driven by the use of ceramic pads as original equipment, the aftermarket has followed suit.

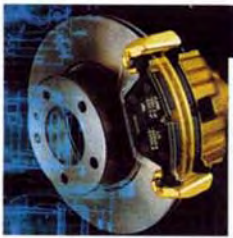
But, Braunstein adds, what works on one application does not work on every application. There are, in fact, only two basic categories of brake friction in common use today for passenger cars and light trucks: non-asbestos organic (NAO), which includes ceramic formulations; and semi-metallic formulations. These two classes are also joined by low-metallic

Continued on page 24

OAN

Science
ords





and carbon metallic formulations, though these are less widespread in their usage.

According to Akebono, an estimated 40% of new vehicle models currently sold in North America feature NAO ceramic friction materials as original equipment. Decisions to use other brake friction materials at the OEM level are often driven by pricing pressures, an ongoing trend among North American OEMs.

"Every car has its own unique dynamic, made up of the size, the weight, the rotor assembly. Each has its specific needs. That need, when it comes to the brake, is formulation-specific. You can't put just any brake in a brake assembly," says Braunstein.

Not using the same friction formulation in a Chevy Suburban and Toyota Corolla, with their obviously different stopping characteristics, seems plain. But different vehicles using the same caliper, and thereby being able to accept a given brake pad, can still have widely varying needs.

Where the challenge comes in for the aftermarket is meeting that requirement without having to unduly burden the supply chain with more part numbers than it can handle.

Jerry Forystek, director of friction product development, Affinia Group, says, "There are more than 1,300 base FMSI part numbers out there," referring to the number of different original equipment designs. "Within each number there may be specific formulations used in specific year, make, and model.

"The aftermarket still has to consolidate. You don't want 1,300 different base numbers." He says that the premium brands' solution has been to approach it by platform.

"The majority of testing we do is to enable us to select the proper friction for each specific part number. We spend a tremendous amount of time and effort doing that."

Other factors beyond size and weight are also part of the equation: disc size, drum diameter, whether it is a disc/disc or disc/drum arrangement, the width of the vehicle, brake swept area, and fluid displaced in a braking event are all taken into consideration.

"It goes on and on. Every vehicle does have its different characteristics." His company tests on some 150 vehicle platforms.

The testing is done both on brake dynamometers and using instrumented test vehicles.

In the brake friction market at large, the amount of testing can vary by supplier, and depends on the engineering capabilities of the organization, economic factors (which can be considerable), and, for lack of a better word, the "desire" by a company to embark on a given amount of testing.

Testing is critical because there is no way to accurately determine the effectiveness of a friction product from its ingredients list alone.

"It is up to the formulator—he puts in the right ingredients along with the right process. It's not just the material itself, but how it's made.

"You can give me the ingredients to bake a cake, but I can't cook."

Forystek says that in there are many different ceramic ingredients used in a given ceramic material. Getting the right mix, and the right process—let's call it a recipe—is no easy task.

When developing friction, everything is a compromise: performance, noise, dust, wear, cost, etc.

In a racecar, for example, cost isn't a big factor, and they operate at high temperature virtually all the time. However, they don't worry about dust or noise.

Other applications may require strong performance in a panic situation, but also are looking for a pad that is free of noise, has low dusting, offer a reasonable pad life, and a host of other performance factors. And they have to do all this at a cost that meets market imperatives.

The result is always a compromise, but arrived at through many testing procedures, analysis, reformulation, and further testing, until the right combination of the 20 or so ingredients makes the grade. It can be an expensive process, and the materials that go into the formulation can also vary widely in quality and cost.

"Some manufacturers typically only react to raw materials pricing and availability when selecting a friction formulation," says Kevin O'Dowd, group brand manager, Federal-Mogul, "We focus more on changing vehicle designs, consumer driving behaviour, and even the dynamic driving environment. As vehicle quality increases, so does the driver's expectation for top performance from all vehicle systems, including the brakes. There is no tolerance for noise, high-effort braking, or dust. An additional factor is that consumers have been driving larger vehicles and carrying heavier loads. And actual driving conditions have become more aggressive, congested, and unpredictable. Our engineers study each of these factors and develop friction materials to meet this increased demand. Plus, as an OE manufacturer, we have the additional insight and knowledge for specific vehicle requirements,"

offers O'Dowd, echoing a growing concern in the industry that economic pressures are putting the squeeze on manufacturers.

It has already pushed many to move production offshore to lower labour costs. Nowadays, say some, continual downward pricing pressure has created a market for products that do not reflect the kind of product testing, fit, and function that aftermarket brake manufacturers have become accustomed to offering (and to seeing from their competitors). And this is all occurring in the face of an increasing

pace of development in friction technology.

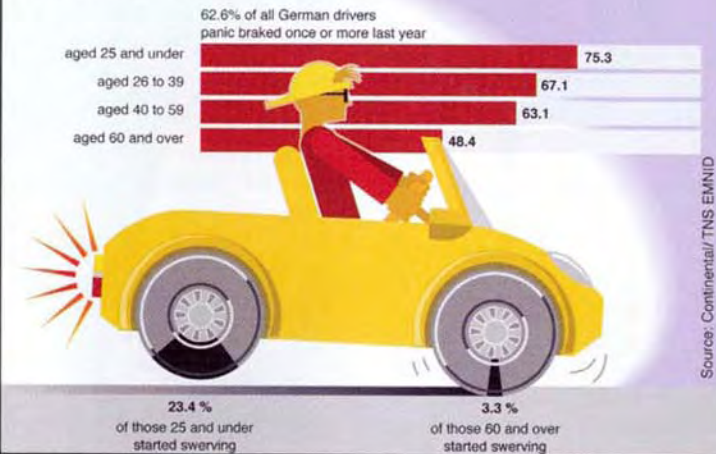
Akebono has already indicated its concern on this point surrounding the introduction of the ceramic class of brake friction. The rise of ceramic friction was rapid at the OE level, and virtually every aftermarket supplier followed suit.

Most aftermarket pad manufacturers offer at least one designated ceramic product, noted Akebono in a recent white paper. This has led to a degree of confusion among many distributors, installers, and drivers, because there is no standard definition in North America of what constitutes a ceramic

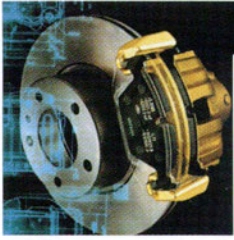
Continued on page 26

Young drivers slam on the brakes more often

Continental Safety Study reveals: Three-fourths of those 25 and under have to brake hard at least once a year



Source: Continental/TNS EMNID



COVER STORY

brake pad, or one set of performance standards that distinguishes NAO ceramic technology.

Consequently, some industry observers have questioned the performance validation processes used by various friction material suppliers in their haste to enter the market.

Depending on the marketer, stated the white paper, a so-called ceramic pad also could be categorized as an NAO, low-metallic, semi-metallic, or carbon-metallic product.

The lack of mandatory standards of any kind, whether to dictate how a brake would be classified or how it will perform, is a recipe for disaster, says Rick Jamieson, outgoing chairman of the Friction Materials Standards Institute and president and CEO of ABS Friction, a private-label brake manufacturer in Guelph, Ont.

"Most people do not realize that there are no standards," he says. "We have rules about talking on the cell phone, but not for what goes into aftermarket brakes." Mandatory standards for aftermarket brakes exist in Europe, and they exist in North America for heavy trucks—but not for passenger cars.

He says that the only widely accepted standard, the voluntary Brake Effectiveness Evaluation Procedure (BEEP), was created, at least in part, to forestall efforts by the U.S. National Highway and Traffic Safety Administration (NHTSA) to impose a standard that would replicate in whole or in part the mandated standards for original equipment brake performance (FMVSS 135. CMVSS 135 in Canada).

And, there is the D3EA that added a level of complexity to the testing designed to closely match those federal new vehicle standards, but has only been used by a few companies.

"We believe these certifications can be misinterpreted by consumers as 'approvals' that are equivalent to rigorous government-sanctioned testing, when, in fact, they are based on dynamometer testing rather than real-world validation," says O'Dowd. "That said, any testing is better than none at all. We believe a manufacturer's OE portfolio in the friction category is a much better indication of product quality."

In Europe, the Reg. 90 standard dictates a brake must perform within 15%, plus or minus, the original equipment part. That standard was too loose for the litigation-happy North American market, says Jamieson, so BEEP testing was designed to ensure that it ensured performance at least equal to that of original equipment.

Still, BEEP is a voluntary standard, not even used comprehensively by all members of the Brake Manufacturers Council that created it.

Jamieson says that the lack of a mandatory standard, while troubling to some (I wrote my first article about it some 10 years ago), was not viewed as necessary. The aforementioned litigiousness of the North American market, and the insurance liability, kept most suppliers in line. Manufacturers made efforts to produce quality because of commercial interests, and tested to a number of engineering standards set by the Society of Automotive Engineers to ensure that they were seen to be a credible supplier by their insurers and their customers.

"The problem today," says Jamieson, "is a lot of grey-market product that is not adhering to any standard. It is a global



market issue." And that, he says, is what has changed in his mind regarding the implementation of mandatory standards. "Brake companies cannot control imports; that is a government job."

He is quick to point out that not every offshore supplier is bringing in substandard product, but he has seen and tested enough of it to believe the problem is big enough to warrant action.

"Canada is a free market country but what we're seeing is product with asbestos that is labelled non-asbestos," he offers as an example. "Asbestos is very forgiving and it tests well." But when the label says it's not there, it shouldn't be there.

Jamieson says it's more than just an issue of wear and content; real performance shortcomings have also been revealed. He says that testing an emergency stop is where the low-quality product fails.

"We have been benchmarking pads, given to us by our customers mostly. We have seen everything from pads catching fire to pads just not making it through the test.

"That is the concern of the industry. I am confident my fellow Canadian manufacturers are quite good. The issue is with product that isn't held up to any standard."

The consumer relies on his technician, who relies in turn on his jobber. "The consumer has no clue what he is getting."

In fact, Jamieson is so alarmed by the situation that he is not content to wait for moves in the U.S. "Regardless of what the U.S. does, we should have a standard [in Canada]. We are a sovereign nation."

So why the big push in Canada? Canada, and in particular Ontario, is the Silicon Valley of the brake industry. There is a very long and respectable history of brake manufacturing in this country, and, he adds, not only is he the outgoing chairman of the FMSI, but the incoming chair, Joe McIsaac, is also a Canadian, and to round out the triumvirate, Ray Arbesman, chairman of the Brake Manufacturers Council and chairman of backing plate manufacturer Nucap, is Canadian as well.

"This is the biggest problem I see in this industry," says Arbesman. "By not having any standards, what happens is a split between what the product was designed for and people who have no idea what the backing plate has to do."

Sitting across the boardroom table at Nucap's headquarters in Toronto, he holds up a backing plate. It is large, perhaps 20 cm long, with a couple of cutouts, and tabs that bend inward on either end. It looks like nothing more than a piece of stamped metal.

"It required about half a million dollars in R&D to make this because of some particular specifications," he says, adding that he has seen other plates for the same application that are dimensionally different enough to cause problems in the caliper. They will fit all right, but they will not function.

Probably best known for its NRS technology that keeps the friction material attached to the backing plate with integrated steel "Velcro" hooks, Nucap has done some testing and investigation of its own that have revealed many shortcomings in product, from backing plates made of poor materials, to pads that delaminate, to, in the worst-case scenario, a brake pad flaming out in a standard wear test.

He echoes Jamieson's sentiments regarding standards. "Before, there was comfort in the market," he says. Everybody was, more or less, working from the same playbook. There was variation in product quality, but it was all within an acceptable range.

That self-imposed limit is now gone.

Now, he says, from 0.2% to 0.5% of brakes suffer from delamination with still-good friction material, with some delamination resulting in complete friction material separation. He even shows an OE example of a brake that suffers from 1% failure of this type.

"Over one million pads are sold a day, without a standard," says Arbesman. "Do we know how they are making their friction material? No. Do we know what glue they use? No. We do know the plates don't fit.

"In the last two or three years, we have moved into a very dangerous zone."

And yet, even among the members of the Brake Manufacturers Council, there is, he says, little will to pursue a mandatory standard. "It has to be one-on-one conversations. "The only thing that will help is a Firestone type of situation. There has to be a big catastrophe; some top executives are going to have to go to jail."

Jamieson believes that at least one reason that so much substandard product has been allowed into the marketplace—not all of it sold out of trunks and on street corners—is that the top executives of some major companies are unaware of just how much is out there.

"I don't think they know."

By contrast, globally, says Jamieson, brakes are viewed with great importance. "What we know as Regulation 90, the European standard, is actually a United Nations standard.

This is the Wild West for brakes in the world."

Overall, Jamieson is concerned that safety issues arising from the use of substandard product affect everyone from drivers, due to poor performance, to workers, through exposure to asbestos and other toxins—he names potassium titanate "whisker" as one that is particularly heinous to work with—as well as the environment.

On the last point, one example has brake manufacturers working with environmentalists in the San Francisco Bay region to lower the amount of copper in brake friction, after some 11% of the copper found in the bay was traced back to roadside brake dust.

Perhaps, he muses, the reduced copper content in brakes, and new resins that reduce greenhouse gas emissions, might be the way that companies differentiate themselves in the future, but the new push for a mandatory standard should not be overlooked.

When pressed on the point of whether there might be a downside to pushing for standards that could play into the original equipment service sector's hands—that they might, collectively, suggest that only OE-branded products should be used—he is quick to respond.

"The public safety is so important, let the OEs say that. The aftermarket brake pad industry is a Canadian industry. I have no fear that the government would hurt us at all."

In the absence of standards, though, what is the supply chain to do? A little due diligence, for one.

Ask what your suppliers are doing to insure that their products are tested to a standard.

Says Arbesman, it is up to everyone to know. "I am sure 98% of jobbers don't want to sell a bad part to their customer. You have to ask the question."

What IS stopping my car?

Do you really know?

The lack of standards for aftermarket brake pads in North America should have you asking that question.

The infiltration of low quality unregulated product continues to stream into North America from countries across the world.

ABS Friction is a concerned North American manufacturer of aftermarket brake pads. We promise you quality, reliability and safe brake pads manufactured to OE standards or higher.

Safety. Our ultimate promise to you.



friction
It's your safety. Ask the question.