



# ZEEEMAIL



## **Zeospheres® Ceramics, LLC**

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### Use of Zeospheres® in Friction Materials

We are pleased to provide new information on the use of ZEEOSPHERES® in another large volume market – friction products (brake and clutch pads, etc.).

#### What Goes Into a Typical Friction Product?

A typical brake or clutch pad contains four types of ingredients:

1. Binder – typically a phenolic resin
2. Fiber – Such as glass, Kevlar, graphite, steel wool and synthetic organic fibers such as polyethylene, polyester and nylon.
3. Organic Particles – Such as ground nut shells and resin particles
4. Inorganic Particles – Such as silica, barium sulfate, brass and steel particles and **ZEEOSPHERES®**.

Normally, a blend of several filler materials is used, which includes some hard and some soft particles to balance friction properties.

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## What are the Advantages of ZEEOSPHERES® in Friction Products?

1. Improved Flow. The critical costs in producing friction materials are not the raw material costs so much as the forming, molding and finishing costs. ZEEOSPHERES® “ball bearing” effect significantly improves flow in molding or pre-molding operations. This results in fewer rejects and also produces products with much more uniform density. One company reported a twofold increase in uniformity of density of brake pads, which by itself produced a substantial reduction in rejects.
2. Reduced Weight. ZEEOSPHERES® density is 20% to 35% lower than most inorganic materials used in friction products, and they are only half as dense as barium sulfate. Therefore, they produce lighter weight brake and clutch pads that not only reduce the total weight of a vehicle but, more importantly, reduce the inertia or “flywheel” effect of rotating parts like clutch plates.
3. Lower Co-Efficient of Expansion. Formulas containing ZEEOSPHERES® are reported to exhibit lower co-efficients of expansion than conventional formulas. This is important in order to avoid cracking of the composite, particularly around rivet holes.
4. Increased Co-Efficient of Friction. ZEEOSPHERES®-containing systems are reported to show higher co-efficients of friction. Several factors influence this, including particle size of the ZEEOSPHERES® and the other particulate ingredients, hardness of the other ingredients, and the glass transition temperature (Tg) of the binder.
5. More Consistent Frictional Performance. Long-term friction testing on a “FAST” heavy-duty brake-testing machine has confirmed that systems containing ZEEOSPHERES® show more consistent friction properties. We believe that two factors contribute to this”
  - Because of their spherical shape, ZEEOSPHERES® frictional properties do not change as the outer edges are worn down. Irregular shaped, ground minerals normally show much more change in shape and friction properties over time.
  - ZEEOSPHERES® high temperature stability means that high temperatures from constant use will not create the kind of crystalline changes or thermal degradation that are common with mineral extenders.
6. Surface Conditioning of Brake Drums. When properly balanced with softer material, ZEEOSPHERES® act as a mild surface conditioning agent which will remove rust, scale and mud film from brake drums. This is particularly important for the heavy-duty brake market where these conditions prevail.

### What Grades of ZEEOSPHERES® are Best?

Experience indicates that ZEEOSPHERES® 600 or 800 series are the best starting materials for heavy-duty applications (trucks, heavy equipment, etc.) because of their lower cost. For passenger cars, the coarser grades can cause “chatter” and the 200 or 400 series are often preferable.