Wear & Particle emissions control in brake pads

1) Project overview

2) Dynamometer testing
Outline

• Project overview

• Dynamometer testing
ITT Friction Technologies

Customer

Production

International Footprint

Sales Geographical area (2014)

Total Disc Brake Pads Sold (mio)

Friction volume posted an average annual organic growth of almost 8% in the 1999-2013 period.

Sales office: Kelsterbach (Frankfurt)
Technical Laboratorio: Kelsterbach (Frankfurt)

Factory: Ostrava

Sales office: Zama-Shi

Factory: Wuxi
Center R&D: Wuxi

Sales office: Pune

Sales office: Novi
Technical Lab: Novi

Factory: Barge, Vauda e Termoli
Center R&D: Barge

$632M

Europe 82%
Nafta 10%
Asia 6%
Latin America 2%
Current materials for brake pads

- **Fillers and Abrasives**: 40-60% vol.
- **Organic Binder**: 10-20% vol.
- **Solid Lubricants**: 5-15% vol.
- **Fibers and Rubber**: 5-20% vol.

**Fillers and Abrasives**
- MoS$_2$, Graphite, …
- Al$_2$O$_3$, ZrO$_2$, Barite, …

**Organic Binder**
- MoS$_2$, Graphite, …

**Solid Lubricants**
- MoS$_2$, Graphite, …

**Fibers and Rubber**
- Metal, Aramide and Glass fiber
Wear & Emission from Brake systems

The wear process between the disc and the pad produce particles and gaseous emissions.

Emissions
Evaporation and Condensation of organics
Fine/Ultra fine particles
Coarse particles

Protocol Analysis
GAS
Abrasives, lubricant, fillers, disc wear...
AKM, Mojacar, Ville taxi....

Mechanism
Understand the wear mechanism
Develop new pad generation with control wear & emissions

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Project idea

- Computer modelling of materials
- New pads
- Vehicle testing
- Dyno & Emission testing

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Dynamometer Testing
Laboratory brake dynamometer LINK M2800

VSB – Technical University of Ostrava
Czech Republic

Parameters:

- Speed: 0-2000 rpm
- Brake pressure: 0-200 bar
- Torque: 0-5000 N.m
- Max. weight of a simulated vehicle: 3500 kg
- Ambient temp.: 20±2 °C

Testing according to recommended practises (AK Master)

Creation of specific testing procedures

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Characteristic value 1 (6 stops, 80 – 30 kph, 3000 kPa)
Experimental Techniques for Characterization of Brake Pads and Products of Friction Processes

SEM

TEM

XRD

Fe⁰, Fe₃O₄

microRaman

Graphite

Amourphous carbon

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