

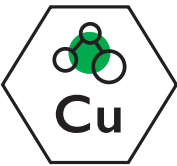
Quality through
innovation.

Brakealloy

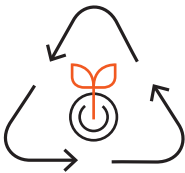
Your key to copper-free

Friction liners

Product range for
sintered and NAO parts



DESIGNED FOR CU-FREE APPLICATIONS



ENVIRONMENTALLY FRIENDLY



EXTREMELY ADAPTABLE



GLOBAL COST SAVER

Background

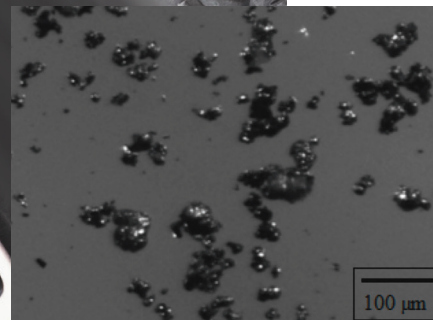
The recently introduced environmental legislation in the federal states of California and Washington (US) has put into question the role of copper powder in organic-based, asbestos-free brake pads for passenger cars. Copper guarantees a near unique combination of friction properties such as efficient heat removal, stabilization of friction behaviour, noise reduction, and low wear of both pad and disc. With no other direct substitute available, an investigation on both new materials and formulations was necessary.

Our R&D approach

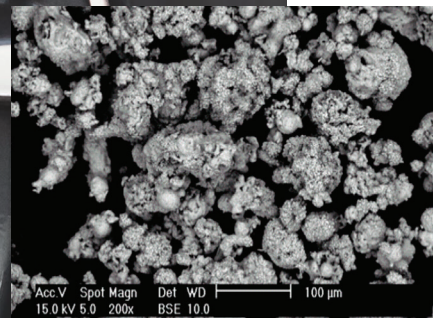
Scientific investigations proved the presence of copper particles in the surface film of the brake pads, also called 'transfer layer' or 'third body layer'. It consistently produced excellent results in frictional brake pad performance during run-in phase. Our Research focused primarily on the 'transfer layer' in organic brake pad systems. We were determined to understand the microstructural and chemical properties, through in-depth advanced characterisation techniques and by establishing how such features affected the brake pad composition and friction behaviour. This resulted in the development of **Brakealloys**, a range of innovative, environmentally friendly, iron based metal powders. These products share a common basic concept, but different thermomechanical properties. This translates into distinct behaviours during braking action, according to their active contribution to transfer layer formation.

Co-developing friction solutions

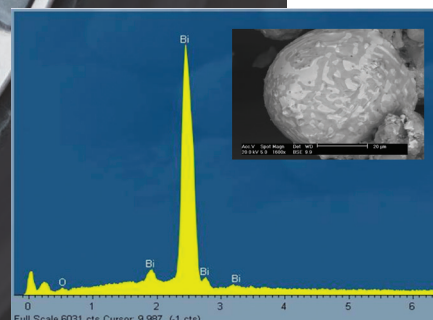
A successful collaboration emerged from our experience in supplying innovative products to the friction sector. Given the immense variety of formulations in use, a one-size-fits-all approach is not believed to be effective. The diverse transfer layer characteristics shown by the **Brakealloys** allow, after a first screening test, the selection of the most suitable grade, according to specific formulation and requirements. The expertise within the Pometon technical team is available to customers, helping you find the most suitable **Brakealloy** and how to extract the most benefit from its introduction in your formulations. Tailor-made product customizations are also possible, and we are available to develop together the most efficient answer to your needs. **Brakealloys** contribution to braking properties and transfer layer development were found to be highly interesting under totally different base mix compositions and friction requirements, mainly in copper-free products.



**Stereo mic. picture
of Brakealloy Z**



**SEM picture
of Brakealloy S**



**EDS of Brakealloy SB
particle**

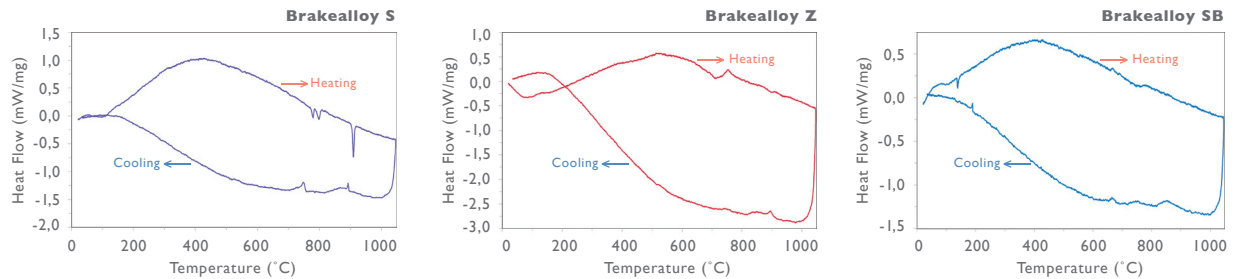
Physical and chemical characteristics

		Brakealloy Z	Brakealloy S	Brakealloy SB
Cumulative particle size distribution (w%)	>250	0	0	0
	>212	< 0,5	< 0,5	< 0,5
	>150	8	8	8
	>45	86	86	86
Apparent density	g/cm ³	2,10	2,50	2,70
Chemical composition	Zn	●		
	Sn		●	●
	Bi			●
	others	<1%	< 1%	< 1%
	Fe	Bal.	Bal.	Bal.

Brakealloys water atomization process was designed and optimized to yield a unique powder shape and microstructure, achieving the best performance and comfort during braking action. Production technology and process are 100% internally owned, thus guaranteeing full control of product properties and reproducibility. Diverse thermo-chemical and microstructural characteristics allow the selection of the most suitable grade, depending on brake pad formulation and user requirements. Further enhancements and customizations are also possible on request; our technical team is at your disposal to offer expert advice and support.

Material	Phases	Hardness (HV ₂₅)	Microstructure stability range
Brakealloy Z	Zn-rich phases	320	< 530 °C
Brakealloy S	Sn-rich phases	750	< 510 °C
Brakealloy SB	Bi- and Sn-rich phases	Bi-rich phases: 20 Sn-rich phases: 750	< 140 °C
Fe (base)	α-Fe	100	< 1535 °C

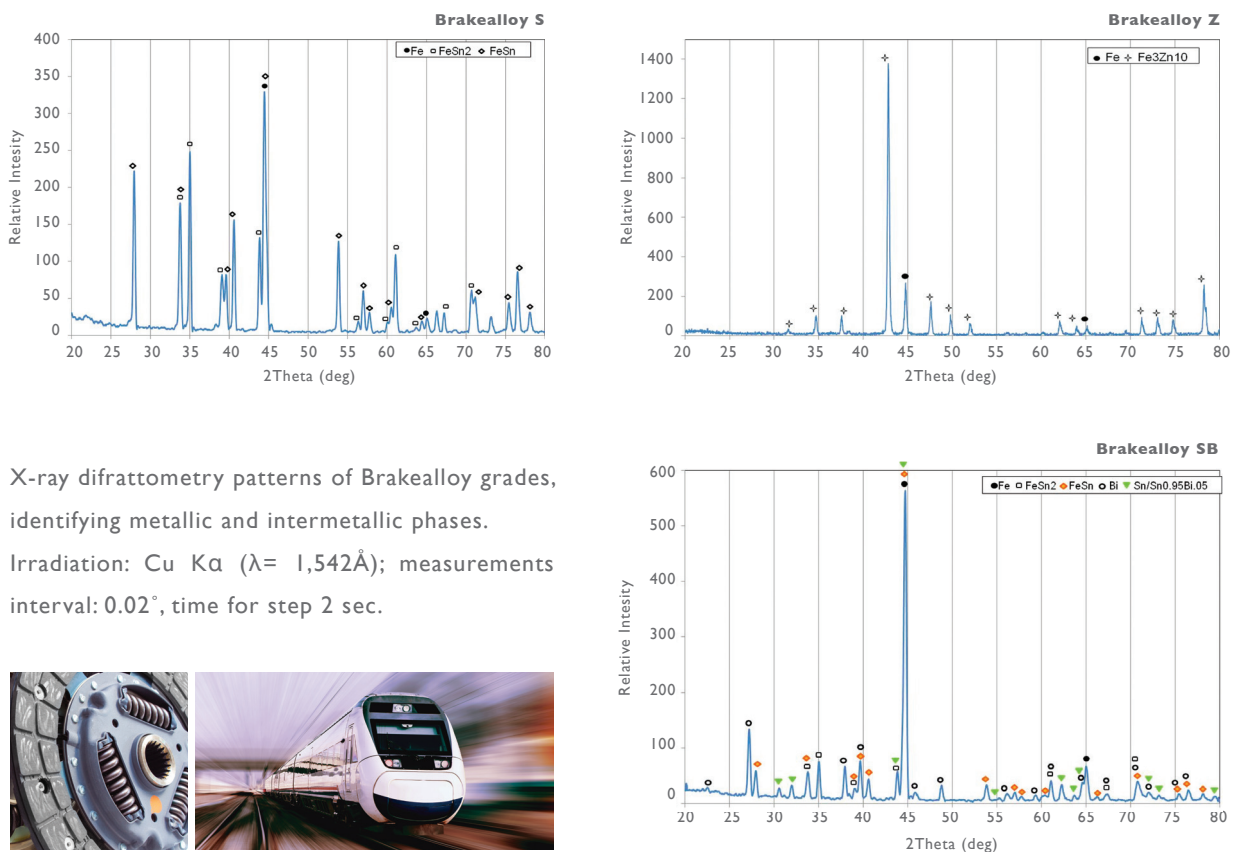
Thermo-chemical properties



DSC curves of **Brakealloy** grades, showing endo- and exothermic peaks in correspondence to phase transformations. Heating rate 10°C/min up to 1000°C, argon atmosphere.

A common concept is embodied in different alloy compositions, featuring a wide range of mechanical and thermochemical properties. This allows the selection of the most suitable solution for optimal friction layer formation, according to existing formulation and application requirements.

In-depth microstructural characterization was performed, in order to understand and control the formation of desirable metallic and intermetallic phases.



X-ray diffractometry patterns of Brakealloy grades, identifying metallic and intermetallic phases.

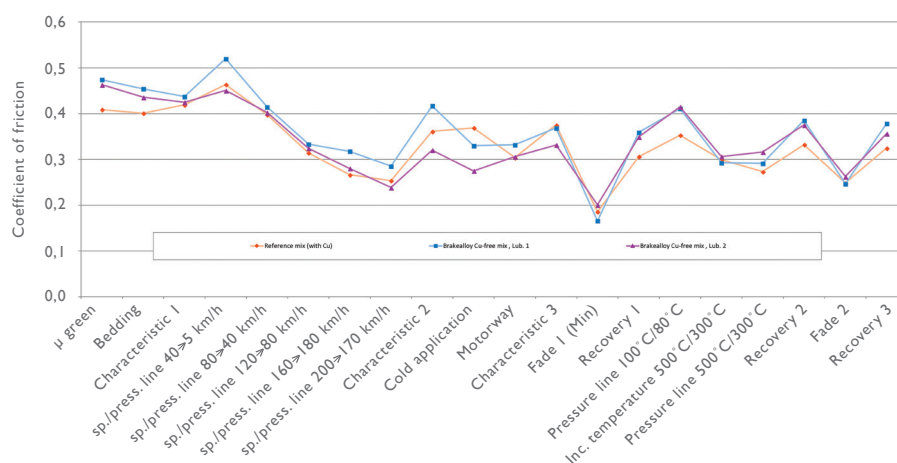
Irradiation: Cu K α ($\lambda = 1,542\text{\AA}$); measurements interval: 0.02°, time for step 2 sec.



Application example on copper-free low-steel formulation

Example of substitution of copper in a low metallic friction material by **Brakealloy** with optimized mix formulation. Influence and interactions of two common sulphide lubricants were also investigated, with a focus on chemical products created during braking.

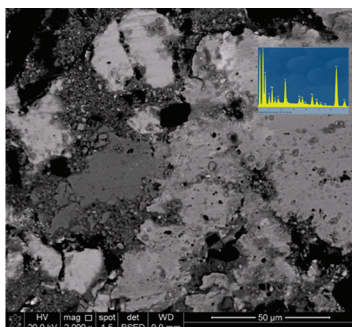
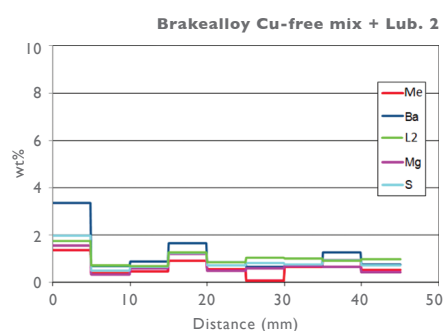
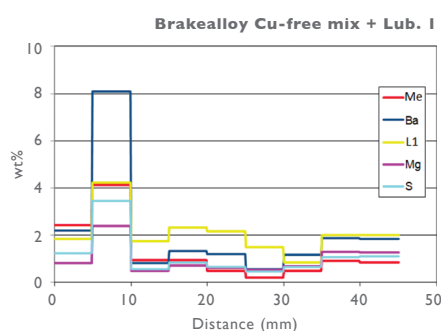
AK-Master test results summary



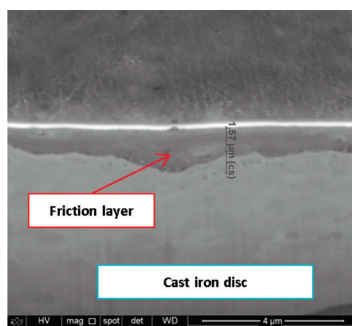
Positive results were achieved after screening experiments for suitable **Brakealloy** individuation followed by friction modifiers selection and adjustment.

Significative metal-lubricant chemical interactions were observed, highlighting the importance of an integrated approach to brake pad material design. Laboratory results with lubricant 2 were used as a basis for successful industrial mix re-formulation.

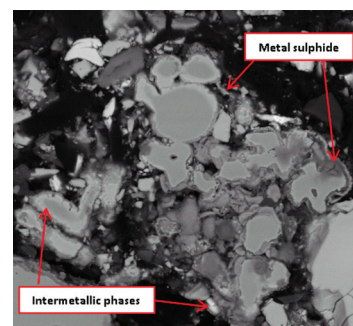
Compositional profile on disc surface, from outer to inner diameter



Brake pad surface
after friction test



Third body layer
on disc surface



Reaction products
after braking

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