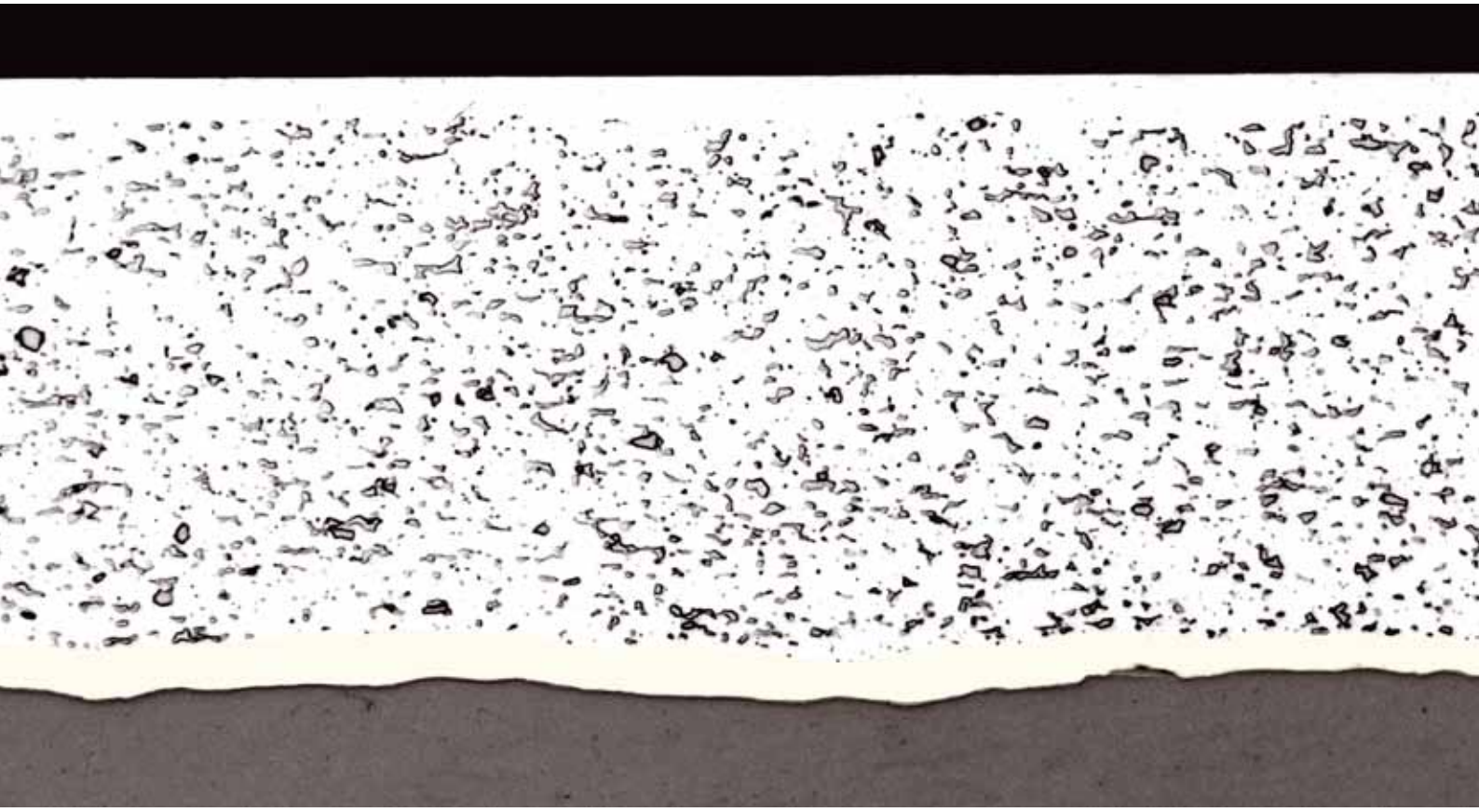
KOLBENSCHMIDT PIERBURG GROUP



KS R25

Lead-free Steel/Aluminum Composite Material for Main Bearings

GLEITLAGER

Brief description of the sliding material

Plain bearings made from steel/aluminum composite materials are widely used as main bearings in gasoline and diesel engines.

KS R25 is a high-capacity bearing material. Given its enhanced wear resistance, good embedding capability and adaptability, KS R25 is suited for the manufacture of bimetal bearing shells, for example. This material is insensitive to oil corrosion.

With its specific load-bearing capacity of up to 60 MPa, this material is suited for application in engines subject to medium to high loads.

In the present chemical composition, KS R25 complies with the requirements of the EU Directive 2000/53/EC on End-of-Life Vehicles.

Bearing structure

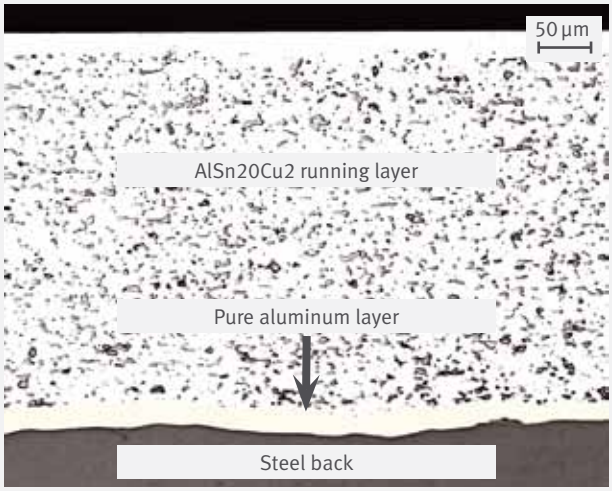
Bearings made from KS R25 comprise a steel back, an intermediate layer made from pure aluminum and an aluminum-tin-copper running layer.

The steel quality used is normally grade DC04 with a hardness in the range of 150 – 220 HB.

The thickness of the steel layer is defined as a function of the application. Usually, it ranges between 1.0 and 3.0 mm.

The intermediate layer made from pure aluminum provides the metallic bond between the steel and the aluminum running layer. Its thickness varies between 0.01 and 0.05 mm.

On the finished sliding element, the aluminum-tin-copper alloy that forms the running layer to the sliding partner exhibits a thickness of 0.2 – 0.5 mm and a hardness of up to 35 – 55 HB.



Micrograph of the composite

Bi-material: steel / aluminum bearings

Material characteristics

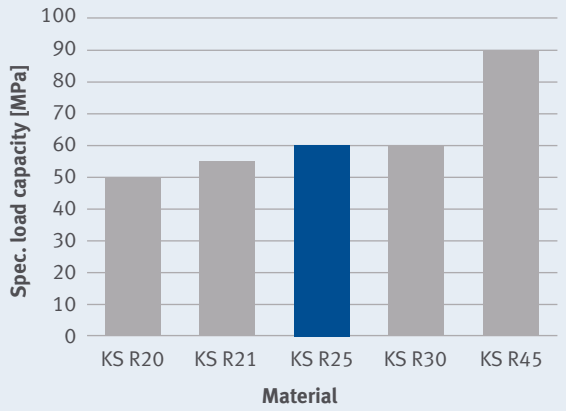
Characteristics, limit loads	Unit	KS R25
Tensile strength	MPa	>160
Yield point	MPa	>130
Young's modulus	GPa	63
Coeffcient of thermal expansion	k^{-1}	$24 \cdot 10^{-6}$
Thermal conductivity	W $(m \cdot k)^{-1}$	50

Chemical composition of the running layer

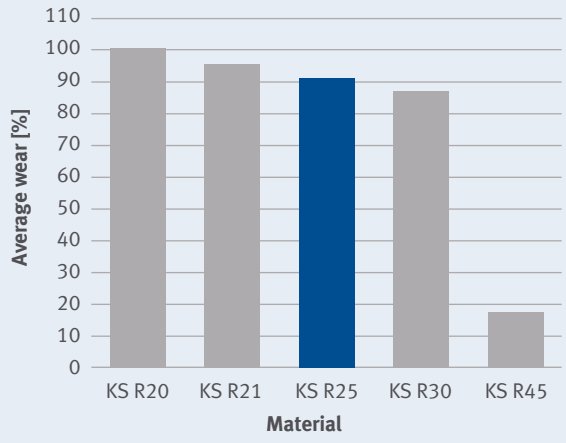
mass-%	Sn	18.5 to 24.0 %
	Cu	1.7 to 2.3 %
	Si	max. 0.7 %
	Ti	max. 0.2 %
	Ni	max. 0.1 %
	Fe	max. 0.7 %
	Mn	max. 0.7 %
	others combined	max. 0.5 %
	Al	rest

The hardness of the running layer is in the range of 35 – 55 HB

Comparison of the specific load carrying capacity



Comparison of wear behavior



Test conditions

- Bearing shell diameter: 47.8 mm
- Wall thickness (approx.): 1.4 mm
- Sliding velocity: 0.25 m/sec
- Spec. static load: 6.2 MPa
- Test duration: 3.0 h

Manufacture of the sliding material

The aluminum alloy is manufactured in vertical continuous casting. Mechanical processing of the strand surface as well as special heat treatment steps prepare the material for plating. The so-called pre-composite results from plating a pure aluminum foil (Al 99.5) on the strand. Roll-cladding is used to apply the pre-composite onto the steel. Selective thermomechanical treatment steps afford the desired material characteristics.

Plain bearing manufacture

KS R25 strip is used to manufacture sliding elements by punching and forming. The final wall thickness of bearing shells and the design of the inside surface is achieved by machining.

Application

Sliding elements made from KS R25 are characterized by their enhanced wear resistance, good embedding capability and adaptability. They are therefore suited for use as main bearings in medium to high-load engines.

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