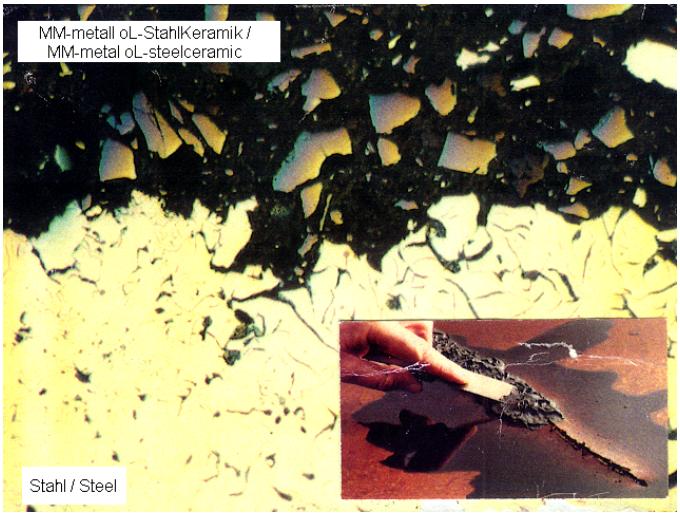
Technical Report PolymerMetall®

TEC-# 006
Microscope photographs, direct-MM-bonding, bonding on contaminated surfaces, pressure tight tests

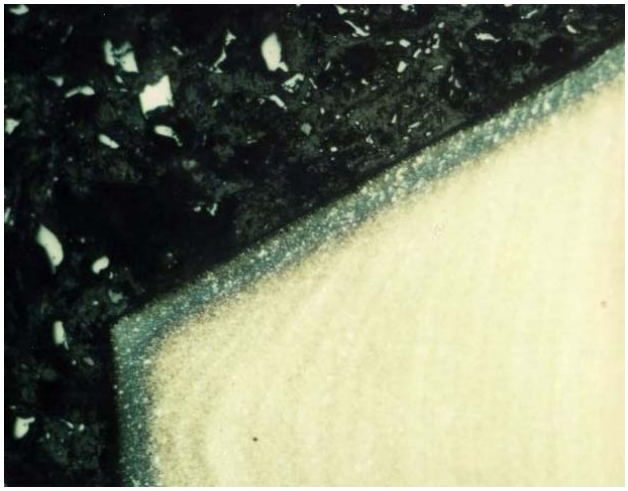
Used products
MM-metal oL-steelceramic

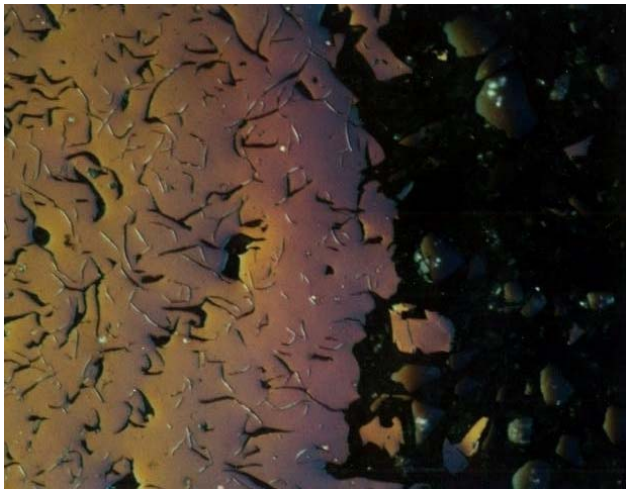
Description
MM-metal oL-steelceramic is a PolymerMetal tested and certified for the repair of oily, greasy or fuel contaminated metals and alloys in case of stress due to cracks, corrosion, abrasion, impact or chemicals. The degree of soiling does not in any way affect the bonding with the structure of the soiled metal surface. High technical data and also the chemical resistance and bonding with the structure on a dirty metallic surface are remarkable features of MM-metal oL-steelceramic.

This technology is approved by Lloyd‘s Register of Shipping.



Microscope photographs / direct-MM-bonding
The following pictures show microscopic photographs of the fully cured PolymerMetal MM-metal oL-steelceramic magnified by a factor of 100 and 500. Here the bonding between MM-metal oL-steelceramic and metallic surfaces (steel or casting), which have been contaminated by various applied oils before, has been analyzed.


on industry gear oil / steel
(Magnification 100)


on petroleum / casting
(Magnification 100)

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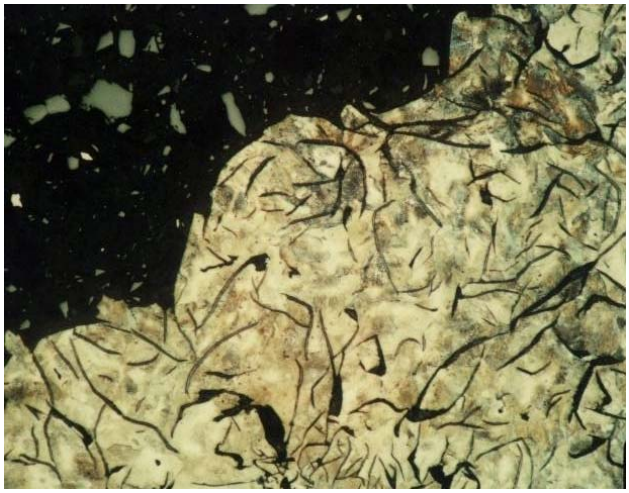
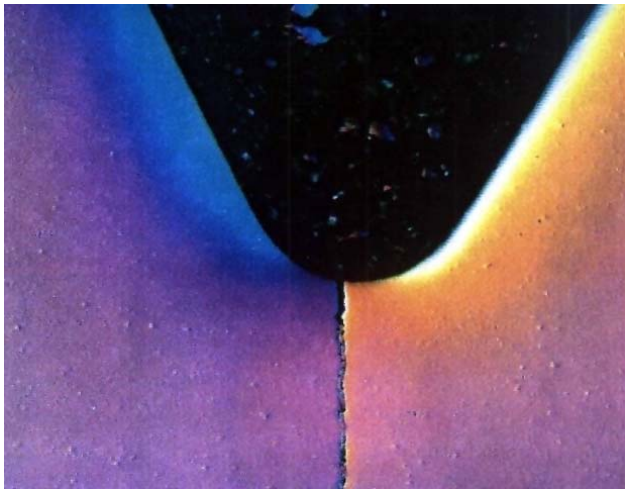
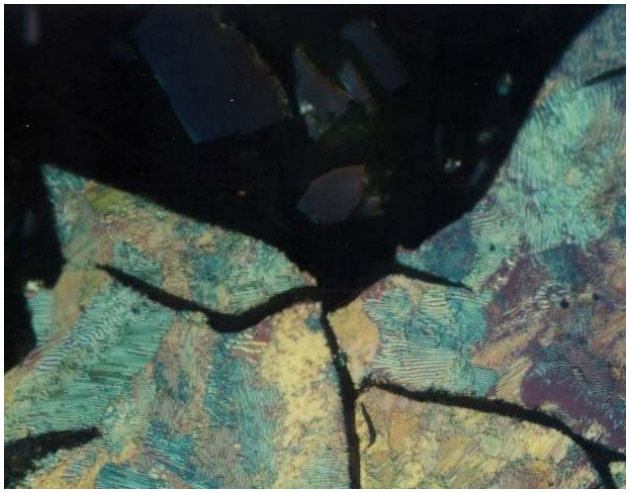
on diesel / steel
(Magnification 100)



on compression oil KSL 68 / casting
(Magnification 100)



on hydraulic oil T 29-50 / steel
(Magnification 100)



on gear oil / machine oil 55
(Magnification 500)

MM-metal oL-steelceramic penetrates and absorbs oil, grease and fuel. The direct-MM-bonding technology secures the direct and high solid bonding on contaminated surfaces.

Bonding on oily surfaces

Tests have been carried out to evaluate the quality of the bonding on different surfaces. At the reference test MM-metal oL-steelceramic and Hardener yellow have been applied to a cleaned (that means oil free) and roughened metal surface. The reference value of 100% stands for the quality of the various determined technical data during bending, shearing & hydraulic tests after total curing time. Other values have been determined by applying MM-metal oL-steelceramic on different contaminated metal surfaces. The test results demonstrate that sometimes better technical values were reached after application on oily metal surfaces than on clean metal surfaces.

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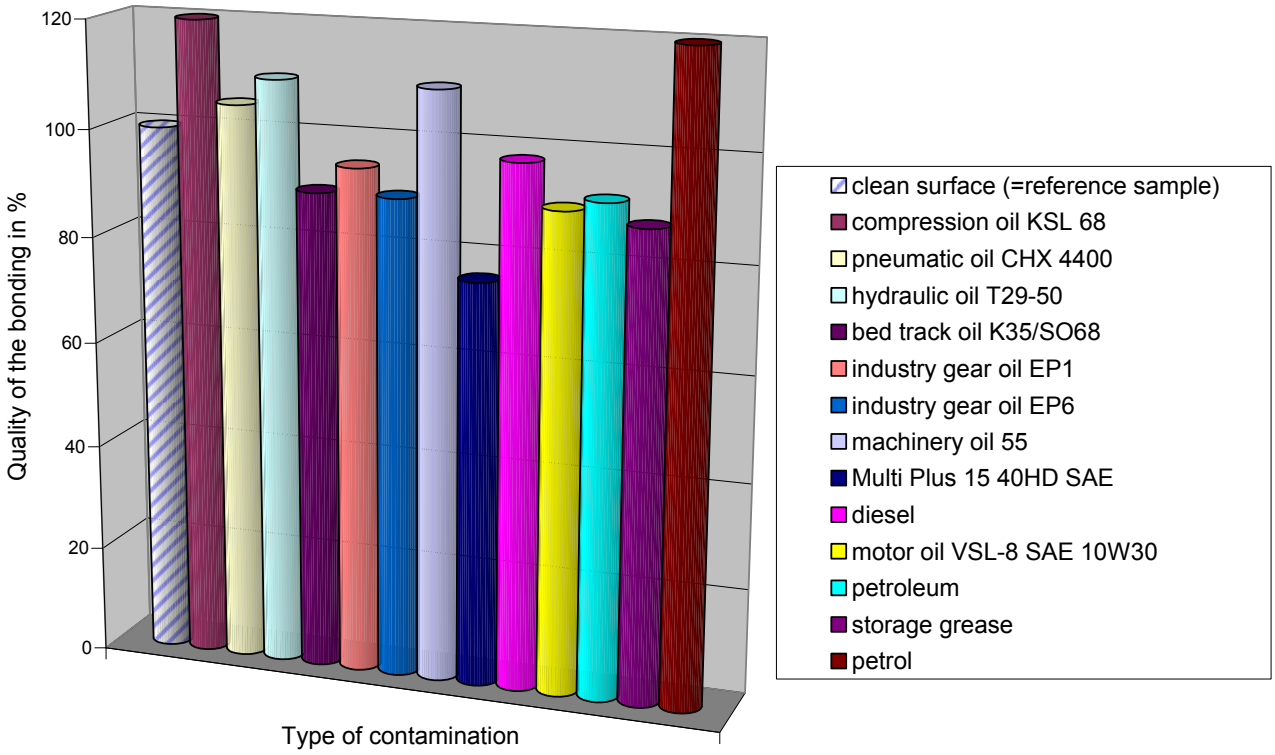
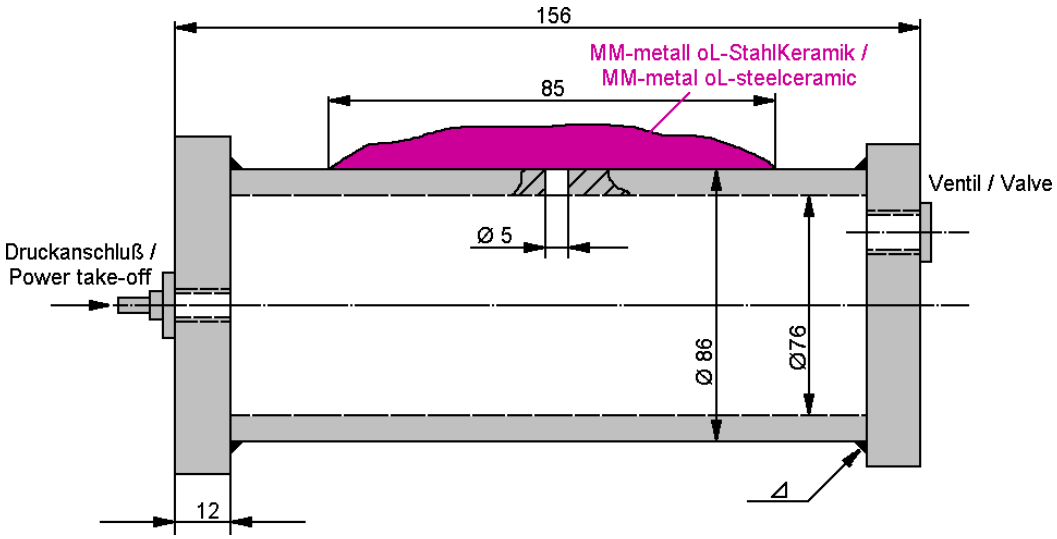


Testing of pressure tightness

To be able to evaluate the quality of the application of MM-metal oL-steelceramic on oily surfaces, tests have been carried out at company M.A.N. under supervision of the classification society Lloyds Register of Shipping. Here special test pipes made off steel have been created according to the following drawing. Around a leakage of a size of diameter 5 mm the metallic shiny surface (Rz 65 µm) of the test cylinder was contaminated with oil. Then the cold-curing MM-metal oL-steelceramic with Hardener yellow was applied around the leakage with a layer thickness of up to max. 8 mm. After full curing of the PolymerMetal the test cylinder has been filled with a liquid and pressure was built up. Then the system was checked against pressure tightness.



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Pressure	Temperature of test cylinder	Auxiliaries	Result
100 bar	20 °C	-	pressure tight
150 bar	20 °C	-	pressure tight
200 bar	20 °C	-	after 8 hours small leakage

In the course of the time the research and development division of MultiMetall was successful to continue optimising the material MM-metal oL-steelceramic and new tests with same conditions have been carried out at MultiMetall. The following results were achieved:

Pressure	Temperature of test cylinder	Auxiliaries	Result
200 bar	20 °C	-	pressure tight
300 bar	20 °C	-	pressure tight
350 bar	20 °C	-	after 2 hours small leakage
150 bar	75 °C	pipe clip	pressure tight
400 bar	75 °C	pipe clip	pressure tight

The pipe clip was fixed around the test cylinder in the area of the leakage. Reinforcing elements as e.g. fibres or mats consisting of glass or carbon have not been used. These would have increased the physical strength essentially.

The tests have been carried out at M.A.N. (test report No. 1731/82) under supervision of Lloyds Register of Shipping (certificate No. 301954) in 1982, the test at MultiMetall in 1995.

Extract of the certificate: „The test results of MM-metal oL-steelceramic may be classed as ranging from good to exceptionally good. All test results were in support of the maker's claim that MM-metal oL-steelceramic will bond on oily surfaces with a high degree of reliability."

Practical example
At Weatherford pressure tests have been carried out with MM-metal oL-steelceramic. The test piece was pressure tight up to a tested pressure load of 4.000 psi (~ 275 bar).

Here are some photographs incl. test records:

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Weatherford CDL 9405R(c)

Program : 1.50
Date : 980825
Part No. : 0
Serial No: 0
Assembly : 0

Acquiring Date 21.01.2006
Acquiring Time 11:00:03

Admin Data

Company ACOTS
Order no.
Operator KLAUS

Pipe Data

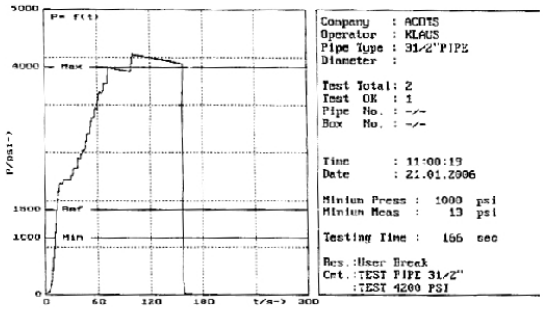
Pipe Type 31/2"PIPE
Manufacturer
Pipe Diameter
Weight
Grade
Lubricant
Comment

Pressure Values

Pressure Range 5000 psi
Max. Pressure 4000 psi
Min. Pressure 1000 psi
Ref. Pressure 1500 psi

Sensor Data

Sensor Type
Sensitivity [mV/V] 2.000



Further information can be provided upon request.

MultiMetall

the MetalExistenceCompany®

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