Bundesanstalt für Materialforschung und -prüfung

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Report

on Testing a Paste Sealant for Reactivity with Oxygen

BAM Reference II-1049/2005 I

1 Application

Customer

MPT Industries
6-B Hamilton Business Park
85 Franklin Road
Dover, NJ 07801
USA

Test Samples

Paste Sealant OC3 for gaseous oxygen service at operating temperatures up to 60 °C;
BAM-Ref.-No. II.1/48 049

Test Location

BAM-Laboratory II.13; building no. 41, room no. 120

Test Procedure According to

DIN EN 1797: 2002-02 „CRYOGENIC VESSELS - GAS/MATERIAL COMPATIBILITY" and „Liste der nichtmetallischen Materialien die von der Bundesanstalt für Materialforschung und –prüfung (BAM) zum Einsatz in Anlageteilen für Sauerstoff als geeignet befunden worden sind"(Edition: 31. August 2004) according to rule BGR 500 „Betreiben von Arbeitsmitteln" Part 2, chapter 2.32 „Betreiben von Sauerstoffanlagen", Edition: February 2005.

TESTREPORT

This test report consists of page 1 to 3 and annex 1.

2 Documents and Test Samples

The following documents and samples were submitted to BAM:

1	test application,
1	material safety data sheet, and
ca. 100 g	of the paste sealant OC3: white paste

3 Test Methods and Results

3.1 Autogenous Ignition Temperature (AIT)

A determination of the AIT was not necessary as the paste sealant is not for use at temperatures greater than 60 °C.

3.2 Ignition Sensitivity to Gaseous Oxygen Impacts

The test method is described in annex 1.

Results:

Sample Temperature t_a	Oxygen Pressure p_a	p_e	Reaction on Impact
60 °C	1 bar	50 bar	no reaction *)
60 °C	1 bar	70 bar	no reaction *)
60 °C	1 bar	70 bar	no reaction *)
60 °C	1 bar	80 bar	no reaction *)[1]
60 °C	1 bar	90 bar	no reaction *)[1]
60 °C	1 bar	100 bar	no reaction *)[1]
60 °C	1 bar	110 bar	no reaction *)[1]
60 °C	1 bar	120 bar	no reaction *)[1]
60 °C	1 bar	130 bar	no reaction *)[1]
60 °C	1 bar	140 bar	no reaction *)[1] [2]
60 °C	1 bar	150 bar	no reaction *)[1] [2] [3]
60 °C	1 bar	160 bar	no reaction *)[1] [2]
60 °C	1 bar	160 bar	reaction on 5. impact *) [3]
60 °C	1 bar	170 bar	reaction on 5. impact *)

*) within a series of five consecutive impacts
[1] brown discoloring of the white paste
[2] brown discoloring of the white paste and white precipitates on the wall of the sample tube
[3] sample mass 0,35g

4 Evaluation

The criteria for a positive test result according to DIN EN 1797: 2002-02 „CRYOGENIC VESSELS - GAS/MATERIAL COMPATIBILITY" is an increase in temperature of at least 20 °C. On basis of this standard there should be no objections to use the paste sealant OC3 in valves and fittings or other components for gaseous oxygen service at pressures up to 150 bar and temperatures up to 60 °C.

However, decomposition reactions of the paste sealant OC3 were already detected by visual inspection after testing at 80 bar or higher oxygen pressures. The discoloring may refer to changes of the materials properties. With regard to technical safety and to our technical knowledge there are no objections to use the paste sealant OC3 in valves and fittings or other components for gaseous oxygen service only at pressures up to 70 bar and temperatures up to 60 °C.

This report does not cover the use of the paste sealant OC3 for liquid oxygen service. A particular test for reactivity with liquid oxygen needs to be carried out to evaluate the compatibility of the paste sealant with liquid oxygen.

5 Comments

This report expires at once, if the composition of the tested lubricant is changed. This report expires on June 30, 2015, at the latest. A prolongation beyond this date is possible, if the manufacturer confirms in writing that the material has not changed since this evaluation.

Products that have been tested by us, and which are on the market, shall be marked according to our evaluation in the BAM test report. A label on a product saying that a BAM test has been performed, and (or) citing our reference number, only, is not tolerable. The use of the product and its safe operating conditions must also be given.

It shall be clear that the product may only be used for gaseous oxygen service. The maximum safe oxygen pressure of the product and its maximum use temperature as well as other restrictions in use shall be given.

Federal Institute for Materials Research and Testing (BAM)

Annex 1

Testing for Ignition Sensitivity to Gaseous Oxygen Impacts

Approximately 0.2 g to 0.5 g of the pasty or divided solid sample is placed into a heatable steel tube, 15 cm^3 in volume. In case of liquids to be tested, ceramic fibre, soaked with the sample, is used. The sample tube is connected by a 750 mm long pipe (internal diameter 14 mm) and a pneumatically operated quick opening valve to a high-pressure oxygen accumulator.

A heater allows to set the sample tube to the test temperature t_a. After the tube and pipe are at test pressure p_a, the quick opening valve is opened and preheated oxygen of 60 °C and of pressure p_e flows abruptly into the pipe and tube. In this way, the oxygen in the tube and in the pipe is almost adiabatically compressed from pressure p_a to p_e and heated. If there is a reaction of the sample with oxygen, indicated by a steep temperature rise in the tube, further tests with a new sample are performed at a lower pressure ratio p_e/p_a. If, however, no reaction of the sample with oxygen can be detected after a waiting period of 30 seconds, the tube is de-pressurized and the test is repeated (up to four times) until a reaction takes place. This means, each test series consists of a maximum of five single tests with the same material under the same conditions. If no reaction can be observed, even after the fifth single test of a test series, testing is continued with new samples at greater pressure ratios p_e/p_a, until finally that pressure ratio is determined, at which no reaction can be observed within a test series of five single tests. If the repetition of that test series with a new sample shows the same result, the test can be finished or continued at a different test temperature t_a.

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Report

on Testing a Paste Sealant for Reactivity with Liquid Oxygen

BAM Reference II-2709/2005 I

1 Application

Customer

MPT Industries
6-B Hamilton Business Park
85 Franklin Road
Dover, NJ 07801
USA

Test Samples

Paste Sealant OC-3-LPS for use in liquid oxygen;
BAM-Ref.-No. II.1/48 109

Test Location

BAM-Working Group "Safe Handling of Oxygen";
building no. 41, room no. 073

Test Procedure According to

„Liste der nichtmetallischen Materialien die von der Bundesanstalt für Materialforschung und –prüfung (BAM) zum Einsatz in Anlageteilen für Sauerstoff als geeignet befunden worden sind"(Edition: 31. August 2004) according to rule BGR 500 „Betreiben von Arbeitsmitteln" Part 2, chapter 2.32 „Betreiben von Sauerstoffanlagen", Edition: February 2005.

TESTREPORT

This test report consists of page 1 to 2 and annex 1.

2 Documents and Test Samples

The following documents and samples were submitted to BAM:

1	test application,
1	material safety data sheet, and
ca. 100 g	of the paste sealant OC-3-LPS: white paste

3 Test Methods and Results

3.1 Reactivity with Liquid Oxygen on Mechanical Impact

The test method is described in annex 1.

Results:

At a drop height of 1,0 m of the falling weight (Impact energy = 750 Nm) no reactions of the material with liquid oxygen could be observed in ten separate tests.

4 Evaluation

According to BAM standard "Testing for Reactivity with Liquid Oxygen on Mechanical Impact", described in annex 1, there are no objections regarding technical safety to use the paste sealant OC-3-LPS in plants or installations for liquid oxygen. In this case, a limitation to a particular pressure range is not necessary as compression of liquid oxygen causes no significant changes in concentration and therefore has no considerable influence on the reactivity of the material.

5 Comments

This report expires at once, if the composition of the tested sealant is changed. This report expires on July 31, 2015, at the latest. A prolongation beyond this date is possible, if the manufacturer confirms in writing that the material has not changed since this evaluation.

Products that have been tested by us, and which are on the market, shall be marked according to our evaluation in the BAM test report. A label on a product saying that a BAM test has been performed, and (or) citing our reference number, only, is not tolerable. The use of the product and its safe operating conditions must also be given. It shall be clear that the product may only be used for liquid oxygen service.

Federal Institute for Materials Research and Testing (BAM)

Annex 1

Testing for Reactivity with Liquid Oxygen on Mechanical Impact

Approximately 0.5 g of the liquid or divided sample is placedinto a sample cup (height = 10 mm; diameter = 30 mm), made of 0.01 mm copper foil. Liquid oxygen is poured into the cup over the sample which is then exposed to the mechanical impact of a plummet (mass = 76.5 kg). The drop height of the plummet can be varied. A steel anvil with a chrome/nickel steel plate supports the sample cup. The anvil, having a mass eight times of the plummet, is supported by four damping elements mounted on the steel frame of the test apparatus that rests on a concrete base.

A reaction of the sample with liquid oxygen is usually indicated by a flame and a more or less strong noise of an explosion. The impact energy, at which no reaction occurs, is determined in varying the drop height of the plummet. This result shall be confirmed in a series of ten consecutive tests under the same conditions. The tests are finished, if reactions can be observed at impact energies of 125 Nm or less (equivalent to a drop height of the plummet of 0.17 m or less). In this case, with regard to technical safety, the material is not suitable for liquid oxygen service.