Technical Data Sheet

Product Name: IPAL Diffusion Coating

Product Number: IP1041

Product Description:

Ipal IP1041 diffused aluminide coating is designed as a protective coating for gas turbine hot section parts at temperatures up to 1000ºC. Ipal 1041 is used for sulphidation protection in industrial and marine gas turbines. Often used on nickel based turbine alloy materials the coating imparts a high temperature oxidation resistant aluminide coating for turbine components in all areas of industrial and aero gas turbine use.

Approvals/Specifications:

- MSRR1041 (RPS603)
- Omat 7/129A

Performance:

Exceeds 140 hours testing at 900^{o}C (1600oF) cyclic burner rig testing with a 2 parts per million dosing of salt.

Components:

Single component coating. May require the addition of de-min water in low humidity environments for spray application.

Application:

Annex 1 of this Technical data sheet

Technical Properties:

Supply Viscosity:	23-27 seconds ISO4 @ 23^{o}C
Flash Point:	N/A
VOC Content:	0 g/litre
Colour:	Grey
Pack Size:	1 Litre
Density:	1.6 kg/litre
Gloss:	N/A
Thinner:	De-min water

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Registered in England: 1376995

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Solvent/Clean Up:	Water
Catalyst:	N/A
Theoretical Coverage:	8.4 sq m/litre @ 50 micron non-diffused condition

Storage:

Highly flammable liquid: store and use in accordance with the flammable liquid regulations

Shelf Life: 12 months temperate; 6 months tropical

Before use, refer to Product Safety Data Sheet

Disclaimer:

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Safety Data Sheets:

For Safety Data Sheets please contact our Sales Department:

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Application procedure

PRODUCT: **IP1041 IPAL**

DESCRIPTION

A spray applied, heat cured, inorganic slurry which when heated in a non-oxidising atmosphere diffuses to form a silicon stabilised aluminide coating.

This coating can be used on nickel, cobalt, & iron base super alloys as well as austenitic stainless steels. The minimum allowable diffusion temperature is 1625°F (885°C) for nickel alloys & 1835°F (1000°C) for cobalt & iron base alloys.

PROPERTIES OF BASIC COMPOUND – IP1041 IPAL

Principal pigments	- Aluminium & Silicon
Total solids by weight - percentage	- 56-62
Density	- 1.6 g/ml
Colour, when thoroughly mixed	- Grey-Green
Viscosity @ 25°C, N°2 Zahn cup	- 16-18 seconds
Viscosity @ 23°C, ISO 4 flow cup	- 25-30 seconds

SAFETY PRECAUTIONS

IP1041 IPAL slurry contains hexavalent chrome making it toxic if ingested and requires care in handling. Avoid contact with skin, eyes & mucous membranes. In case of contact, immediately irrigate affected area with running water. If contact is severe, obtain medical attention. Self-contained or air fed respirators should be worn while spraying the coating. Well ventilated spraying areas with a high exhaust rate should be used.

Phosphine Gas: During diffusion metallic phosphides can be produced in the coating. These compounds hydrolyse in the presence of airborne water vapour. Phosphine is highly toxic and parts should be placed in a well ventilated area with an RH of 50-60% after diffusion. Ventilation should be at the rate of 1-2 air volume changes per hour. Personnel handling freshly diffused parts should be equipped with air fed respirators. The diffused parts should be aged for 24 hours in the ventilated area prior to handling.

A phosphine gas detector can be used to monitor the working and storage area.

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APPLICATION PROCEDURE

1.

1.1 Determine the surface area of parts which is to be coated.

1.2 Ascertain what resultant diffused coating thickness is required (per applicable specification).

1.3 Determine the coating weight per unit area which should be applied to obtain proper coating thickness. As a guideline, to achieve a typical diffused film thickness of 25-37.5 microns a target coating weight of 19-24 milligrams/cm^2 should be applied. However, the exact relationship between the weight of applied coating & aluminide thickness can only be determined by sectioning diffused parts.

1.4 Determine the total weight of coating to be applied by multiplying the weight per unit area value (from step 3) by the total surface area to be coated (from step 1).

2.

2.1 Vapour degrease thoroughly using 1,1,1-Trichlorethane or equivalent.

NOTE: From this point on, parts may be handled only with lint free double cotton gloves. It has been noted from numerous trials that latex gloves leave a finger print that will affect the quality of the coating.

2.2 Mask surface areas not to be coated.

2.3 Grit blast, using clean, new 120/220 mesh Al_20_3 (aluminium oxide) at 60 psi line pressure & 6-8 inch (150-200mm) nozzle work distance.

2.4 Remove all masking.

2.5 Remove all residual grit by alternate brushing with a clean bristle brush & by blowing off with clean compressed air.

NOTE: Cleanliness of part surface to be coated is critical & contamination will produce seriously defective coatings.

3.

3.1 Determine bare (grit blasted) weight of part or parts to be coated.

NOTE: Assign appropriate number of control samples to each batch of parts, & determine the area to be coated & the bare weight & process the control samples simultaneously with parts.

3.2 Re-mask areas not to be coated.

4.

4.1 Before removing any of the contents from the container of IP1041 IPAL, shake, stir or use some means of mixing the solution until all of its solids are entirely and uniformly dispersed into the solution.

4.2 Spray IPAL IP1041 on grit blasted area. Apply thin even coats and allow to flash off to matt grey between each application.

4.2.1 IP1041 is applied initially as a mist coat to wet the metal substrate. When this coat has dried to a matt grey, additional thicker coats may be applied.

4.2.2 In climates where humidity levels are low, an addition of up to 10% demineralised water may be added to aid flow of the applied coating. The presence of dry spray on parts is a good indicator that a water addition is required.

4.3 Weigh part, and by difference, determine amount of coating weight which has been applied.

4.4 Repeat steps 13/14 until the proper weight (as determined in step 4) has been applied.

4.5 Oven dry at 175°F (80°C) ± 25°F for 15 minutes minimum. Remove masking.

4.6 Cure coating at 650°F (340°C) ± 25°F (part temperature) for 30 minutes at temperature.

4.7 Inspect coating for crazing, mud cracking or any other visible surface defects. Defective parts must be stripped & reprocessed.

4.8 Perform final pre-diffusion inspection.

DIFFUSION TREATMENT:

5.

5.1 Rack coated parts in a manner such that the coated area is not in contact with rack or retort. Diffuse parts in one of the following atmospheres:

5.2 Argon (dew point less than -40°) at a flow rate sufficient to guarantee six (6) furnace volume changes per hour. Purge furnace for one (1) hour before heating parts.

or – 5.2.1 Hydrogen (dew point less than -40°).

or - 5.2.2 Vacuum with an argon backfilled partial pressure of 5×10^{-2} Torr.

Caution; evaporated aluminium may contaminate the furnace and reduce the usefulness of the equipment for other processes.

DO NOT USE A NITROGEN ATMOSPHERE.

NOTE: The coating will diffuse at temperature from 1625°F (885°C) up to the solutioning temperature of the base metal, diffusion time & temperature schedules can be tailored to match the heat treatments for the alloys.

The two-phase coating structure can be produced using the alloy solutioning treatment as the diffusion treatment; however, the parts must be allowed to equilibrate at 1625°F (885°C) for ½ hour

during heating to the diffusion temperature. The heat treatment of the alloy must be completed after the diffused parts have been cooled & cleaned.

If the single phase aluminide is desired on nickel base alloys, coated parts should be diffused at 1625°F for two hours. DO NOT DIFFUSE COBALT PARTS AT TEMPERATURES BELOW 1800°F (980°C).

Questions concerning diffusion treatments should be directed to the manufacturer of the component or to IPC

6.

6.1 After diffusion treatment, place parts in a well ventilated area.

6.2 When the parts have cooled, the resulting bisque residue should be removed by light blasting at 10 psi with glass beads.

Removal of the bisque can be enhanced by placing the coated parts in a humidity chamber, typically with a RH >90% and a temperature >40^{o}C

7.

7.1 Complete alloy heat treatment for any diffused parts which have been exposed to solutioning temperatures. Refer to manufacturers procedures for the necessary conditions and heat parameters.