THE USE OF NON-CONVENTIONAL TECHNOLOGIES IN IMPROVING THE LIFE OF AIR WHEELS PRESENT LT

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This paper presents a proposal to increase the life of the air wheel refurbishment and wheel drum aviation technology using thermal plasma spraying. As the aircraft wheels during operation subject to extreme stress is necessary to ensure their proper operation and adequate maintenance. In many cases, the wheel wear occurs to the formation of cracks in the drum wheel, which prevent its further operation and use. Thus, the wheel must be discarded and replaced. This effect is uneconomical and it is better to use a method of increasing life by means of thermal spraying because, first, prolonging service life of the wheel and also will save the cost of buying new wheels.

K e y w o r d s: Aircraft wheels, Renovation, Offbeat, Blasting, Thermal spraying plasma …

1 INTRODUCTION

Aircraft wheels are one of the most important parts of the aircraft. Load transmitted to the aircraft during its take-off, landing and maneuvering around a track. Therefore, it is necessary to pay close attention to the proper maintenance and operation. During their operation leads to the natural wear and damage to later result in the impossibility of further operation of the wheel and therefore they should be replaced with new.

The aim of this paper is to summarize the basic characteristics of aircraft wheels. Describe their basic design, the materials from which they are produced, load and operational analysis of damage and malfunction.

The result of this paper is a proposal technology refurbishment of aircraft wheel drum so as to meet all the necessary features and also extending its service life.

2 DESIGN AND STRESS ANALYSIS AND WHEELS AIR TRAFFIC DAMAGES

Aircraft wheels are an important component of the landing gear . Tires installed on them bear the entire weight of the aircraft during taxiing , takeoff and landing . Typical aircraft wheel is lightweight, strong and made of aluminium alloy . Some wheels are made of magnesium alloy . The first aircraft wheels were constructed in one piece just like a modern car wheels . How to improve aircraft tires for the purpose to be served tougher and better absorb the landing forces without cracking or separation from the disc . Deployment of such tires on one piece disc was not possible . It was developed by two-piece wheel . The first two-piece aircraft wheels were actually one-piece wheels with removable tires, which give access to tire. These can still be found on older aircraft . Later wheels were developed with two nearly symmetrical halves . Almost all aircraft used in this two-part structure .

Among the most serious and the most damage occurring on the drum support wheels that could be taken into consideration when renovating drum features:

1. Damage slot for removable attachment associated semicircle. Damage is usually different sizes and it is determined to what extent the damage is permitted.

2. Of mechanical damage is bruised backside (a hammer when removing the tire). Authorize the bruising to a depth of 1.5 mm for 60% of the area. Drum, applied over the back surface discard.

3. Special kind of damage to the front hub drum wear. Under intensive braking may cause detachment of a steel gear wheel encoder and an inertia of friction, the wear face of the hub up to 1 mm. In technological practice, this kind of damage is not mentioned and thus damaged drums are discarded.

4. Frequently occurring damage tracks are considerable wear skirt and detachable drum semicircle. Damage to the rim may be in three places to a depth of 3 mm without cracks. When the damage goes beyond this drum is taken out of operation.

5. Some of the electron in the surface of the drums, as well as on the bearings pressed steel housing, in many cases, corrosion occurs. Corrosion to 25% of the subject renovation. Technological regulations state that the corrosive zone and occurring cracks to a depth 0.5 mm still subject to renovation.

Brakes damages:

Overheating:

During deceleration aircraft changes kinetic energy into thermal energy. Overheating the brakes is undesirable. Excessive heat can damage brake parts and disrupt and weaken them to the point of failure. System that ensures the use of the brakes is designed to prevent overheating. As brake shows signs of overheating must be removed from the aircraft and checked whether there are any damage. If the aircraft during take-off takeoff is interrupted, the brake must be disassembled and inspected to determine whether withstand such a high level of burden. Standard control in the event of overheating includes Removing brakes from aircraft brake distribution. All seals must be replaced.

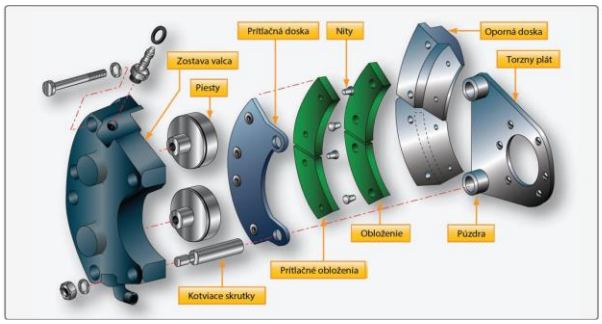

Fig. 1 Assembly of aircraft wheel


Fig. 2 Overheated brakes after landing

Jams:

Jamming the brakes is a condition caused non lining from the brake disc in situations when releasing the brakes. This may be caused by many different factors and. Brakes are basically stuck partially hampered all the time. This can cause overheating and wear of the lining resulting in damage to the disc. The brake may be stuck if the return mechanism is not working properly. This may be due to poor return of spring, reciprocating pin is automatically retracted to its original position, or any other similar failure.

Noise and whistling:

Brakes may snap or whistle when the brake pads are not after drive smoothly and evenly. Wavy disk via multiple causes in conditions where braking effect is unused and used many times per minute. This causes rattling and high frequencies and whistling. Any deviation of disk out of place causing the same effect. Discs that have been overheated may have damaged friction surface of the disc. Some of overheating may also spread to the adjacent surface of the disk and this leads to the formation of unwanted vibration or squeaking.

Bearing damages:

Seize:

It is caused by dry friction contact surfaces. Metal rubs and thus warms the metal surface is destroyed and created deep scratches that lead to complete blockage of seizing and bearing and thus jamming the wheel.

Pitting:

Cyclic stresses orbital rings and rolling elements results in fatigue. Normal fatigue is manifested by cracking and chipping rolling surfaces so. pitting.

Overheating:

It is caused as a result of inadequate lubrication. Surface color changes in the bluish tint. End bearing shown in FIG been overheated and caused the metal flow and deformation as well as discolouration


Fig. 3 Bearing of wheels damaged by overheating

Disc damages:

A thorough visual inspection at each wheel semicircle should be conducted on the discrepancy from the conditions listed by the manufacturer for servicing the wheel. It is recommended to use a magnifying glass. Corrosion is one of the most common problems in the control of the wheel. Places where it gets moisture should be carefully controlled. It is possible to remove the corrosion according to the instructions of the manufacturer. Authorized protective coating and surface treatment must be applied before returning to service wheels. Corrosion in excess of prescribed limits is the reason for exclusion from the operation of the wheel.

Fig. 4 Wheel halves

3 SELECTING METHOD OF PREPARING OF SURFACE AND SELECTION OF NECESSARY TECHNOLOGY

Currently, the most widely used method of preparing the substrate surface is blasting. Benefits of matter blasting mats are:

1. Blast surface of the substrate is brought into a state of thermodynamic equilibrium with the surrounding environment. Surface of the substrate is chemically activated due to the release of atomic bonds of surface atoms. As a result of chemical absorption of gas from the atmosphere and oxygenation is the chemical activity of the surface decreases rapidly, so it is necessary to convert thermal spraying up to 2-3 hours after blasting mats.
2. Blast the roughened surface of the substrate This increases the area of contact under the deposition particles.
3. Blast increases surface microgeometry surface of the substrate, which has a direct impact on increasing adhesion coating layer.

As a suitable blasting material is used **Brown corundum:**

Reusable synthetic material based on alumina (aluminium oxide). It has a sharp-edged grains. Mohs hardness scale is more than 9 One of the most durable abrasives, applicable where those which require high quality surface finish


Fig. 5 Brown corundum

Generally was the process of creating thermally sprayed coatings technology described as fusing the filler material particles are accelerated and applied to the pre-treated surface of the base material.

After the impact of the base material, a partial or complete deformation of the impacting particles gradually solidify very quickly, they cool and form a heterogeneous structure. Schematic cross-sectional view of a coating are visible boundary between the deformed particles and between applied layers of the coating. It can be seen closed pores in case of non-technological processes, and defects such as cracks, microcracks, an unrelated individual particles in the coating, oxidized particles non-melted particles and the like.

Benefits of Cluster coating are:

1. Resistance to mechanical wear

2. Excellent tribological properties (self-lubricating, lubricants, sealants coatings)

3. Resistance to oxidation, corrosion and against the action of aggressive chemical environment.

4. Resistance to extreme temperatures.

5. They can be applied to all common construction materials.

6. When applying materials technology Thermal spraying is not critical condition and chemical composition of the base material or panel member. Which protect watching.

7. During the coating process there is no heating of the base material of the temperature higher than 150oC. During application of the coating material, there is no degradation of the structure due to the thermal effect on the base material nor the deformation of the coated part.

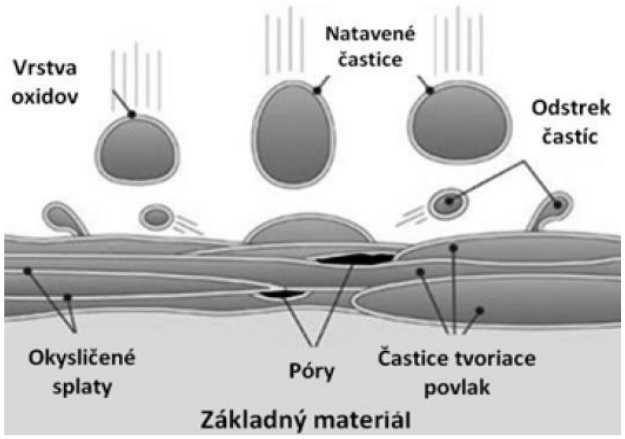

Fig. 6 A schematic cross section of a coating

Plasma spraying process essentially consists of three successive phases:

1. Plasma formation and transformation of electrical energy into the plasma gas which is heated and accelerated.

2. The interaction of plasma particles of the additive material being carried layering, in which some of the energy is transformed into plasma consumables.

3. Deposition of the particles of additive material to the prepared substrate, wherein the thermal and kinetic energy of the particles transferred to the substrate.

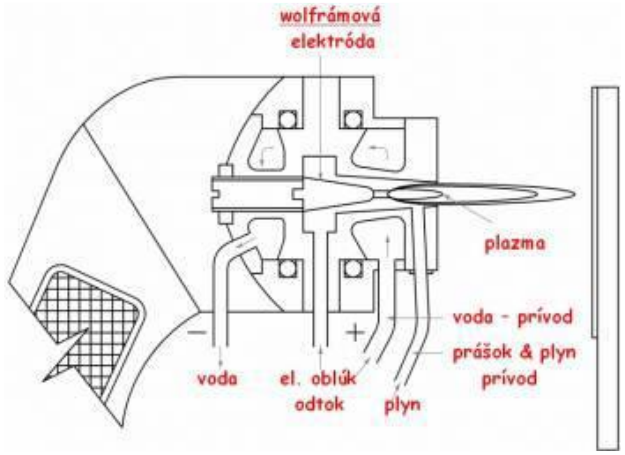

Fig. 7 Principle of plasma torch

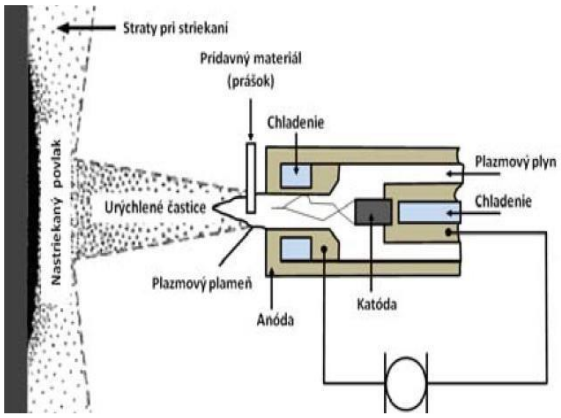

Fig. 8 The principle of plasma spraying

4 PROPOSALS AND PROCESSES OF RENOVATION DRUM AIR WHEEL

In this part of the paper explains how the renovation drum wheel air and increase its life by using plasma spraying. They are also well described all the necessary technological conditions so that the procedure was done correctly and that the quality of the feed and the corrected wheel responded to the requirements of operation.

Chart technological renovation process air drums Alloy wheels –MgAlZn:
a) The first correction

1. Defectoscopy - finding cracks in the drum wheel

2. Mechanical machining surface of the wheel - trimming the cracks n = 100ot./min., Displacement along the axis S = 0.02 mm / rev.

3. Treatment (blasting) Electrocorundum - Electrocorundum N30: grain diameter of 500-630μm, pressure P = 0.3 to 0.5 MPa, distance from the blasting area l = 120 mm

4. Cluster coating plasma - current I = 475-500A, the amount of plasma gas Q = 36-37 l, the distance from the drum burner L = 200-230 mm, the transport gas to the powder A1 = 2.1 l / min. Powder Metko 404

5. Mechanical surface treatment coating - n = 255-260ot./min., Feed the tool axis .05 to 0.06 mm / rev.,

6. Degreasing - use NaOH + Cr2O3

7. Oxidation - the time t = 30-60 sec., Temperature T = 60 - 70 ° C, the composition of the oxidizing solution: K2CrO4 + Cr2O3 + (NH4) 2SO4 + CH3COOH + H2O

8. The application of paint - paint S-2008 (basic) + lacquer-2013 varnish layer thickness h = 110 ± 10 mm, temperature T = 150 ° C, t = 30min.

9. Plaque control: a) visual, b) the geometric dimensions

10. Putting into operation

b) The second correction

1. Removal of surface coating

2. Working electrocorundum

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3. Plaque control

5 GENERAL KNOWLEDGE AND BENEFITS

1. The technology repairs brake wheel allows you to repair aircraft significantly large proportion of all currently used wheels. Analysis of the properties of coatings and coatings application methods have shown that it is possible to restore the wheels made of magnesium alloy and other alloys. It is recommended to use a thermal plasma spraying.

2. Based on analysis of these modes can be optimally set the application mode: plasma current I = 475 - 500A, plasma gas Q = 36-37 l / min. distance l = 200-230 mm plasma spraying drum wheel that provides the coating porosity 2-3%.

Advised that the proposal technology renovation skid coating using blast cleaning technology Electrocorundum thermal plasma spraying powder Metka 404 with subsequent mechanical working and applying paint S-2013.

Based on the above it can be concluded that the use of unconventional application process technology in the renovation of air drums wheels refurbished aircraft allows substantial majority of damaged wheels only on the basis of magnesium as well as duralumin, and titanium and other alloys that are currently discarded and increase their longevity. Since the thermally spraying plasma regardless of the material of the substrate to which the coating is applied. This technology can be applied to all types of air wheels that are currently used. Economic effect in the future reflected spared the cost of buying new wheels.

Wheels aircraft are extremely important part of any aircraft operated. Their durability, endurance, reliability and durability are the most important characteristics. Since they are subject to wear and damage during operation must be sufficiently by maintained and checked. to meet the desired properties and thus ensure the airworthiness of the aircraft under all operating conditions.

This post has the task of construction of aircraft wheels, materials from which they are produced, to analyze the damage and failure to appear in traffic and in particular the design of effective and unconventional technology renovation drums aircraft wheels, which would increase their service life and reliable operation.

The technology appears to be very suitable for aircraft wheels, because it can be used for virtually all types of wheels, independently of their material, and when thermal spraying there is no structural change in the base material. You can even fix those that could not be repaired by conventional methods repairs. Thus, not least spared the costs associated with replacement of damaged wheels that were in the ordinary course of recovery repairs decommissioned.

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