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The current experience of applying the composites in practicing the industrial equipment maintenance

Challenging problem.

Over the last years the composite materials on adhesive bases with the added nanopowder and the modifying agents required become more common in practicing the industrial equipment maintenance [1-3]. However during maintenance of the metallurgical production machines such applying is typically occasional and is not a constituent part of current and general maintenances procedure. In Pryazovia State Technical Engineering University they gained a big experience of nonstandard maintenance situations solution, which arise during operation of the metallurgical equipment, which the enterprises' maintenance services can use successfully and this is the reason why the material provided below, is presented as well-timed and currently central [4-6].

Purpose statement

First and foremost, it should be said that the composite materials significantly are inferior in strength to the steel articles, the weld surfaces or the welded seams. Judging from these points of view there is no worthy alternative to the welding engineering. But in the following description it will be shown that there are cases when applying of traditional maintenance technologies either cause big material expenditures or can be used provided that they stop the device for a long time to replace the component which is out of service, with a new one [7-8]. At the same time when we use the composite materials we not only have an opportunity to conduct the maintenance in the shortest time possible, but to give new lease of life to the remanufactured components as well.

Nevertheless many examples of the composite material utilization in metallurgical maintenances have no connection to operation in the conditions of the heightened temperatures, so the following examples of maintenance are devoted to analysis of their maintained equipment successful utilization.

Information

The first example is a case of putting into operation the continuous casting machine, in which in the process of operation there were water leakages through compressions, set at the crystallizer jigging frame and seal hermetically the quenching water supply to crystallizer.

In the process of operation the slot in the frame, where the rubber seal is being put, corrodes and cannot fully hold the compression in the set position. This is where the water leakage comes from and so there is a need to restore the leak-tightness of the water supply system to the crystallizer. The conventional way out is to disassemble the mill shoe with the worn-out riffles, the welding deposition and the stock removal with fitting riffle for the compression installation. Upon that the stopping of the machine, taking into account disassembling, restoration and assembling, is a pretty long process, provided that there is a prepared technology and equipment for restoration. By virtue of the composite materials this maintenance problem can be solved in 2 days. The key point of restoration, as we can see from the figure 1, is in setting tape tool from the stainless steel in the supply hatchway and its fixturing to the mill shoe by welding tacked spots. Then the cavity, formed between the welded sheet and residues of the conduit for compression they fill with the composite material, process the rubber seal with the releasing agent and put it into the former riffle for the tall beacon, which restricts its depression on a level lower than the required one.

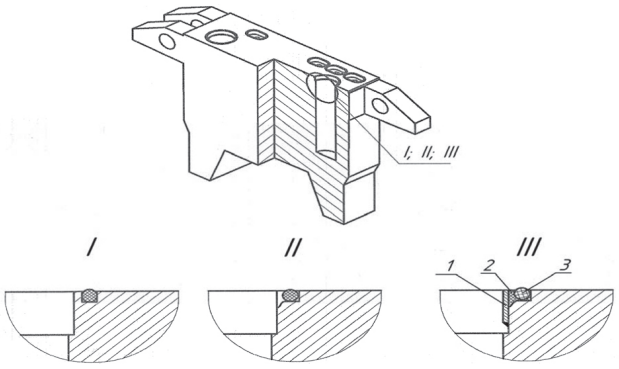


Figure 1 – The crystallizer frame phases of the construction leak-tightness restoration: I – the initial state of the new crystallizer; II – the worn-out riffle under the compression; III – the restored riffle under the compression (1 – the tape tool from the stainless steel; 2 – the composite material; 3 – rubber seal, processed with the isolating switch)

In 6 hours (if t° of the medium was not lower than 15°C) they extract the seal, delete the residues of the embossed composite material and put the seal back into the riffle formed by it. So what is the advantage of this technology? The terms of maintenance are significantly shortened. The probability of repetition of the leakages is excluded, as both the stainless steel and the composite material are not exposed to corrosion and will serve longer than the mill shoe with the riffle for the compression will. This is the most impressive example of applying the new maintenance technologies, which alongside the shortening of the maintenance terms and increasing of assembly unit service life comparing to the initial state. Taking into account the uniqueness of performing such maintenances on the other machines and reliability concurrently discovered of the restored sealing joint, so such technology can be recommended for extended application.

Performance of the continuous casting machine metal structures protection by polymer protective coatings is advantageous and economically viable, as they do not requires any special equipment and can be applied to coat the large areas of the metal structures.

In such a case, the algorithm of their protection looks as follows:

– surfaces conditioning from the paints or corrosion build-ups;

– degrease cleansing treatments of the surfaces;

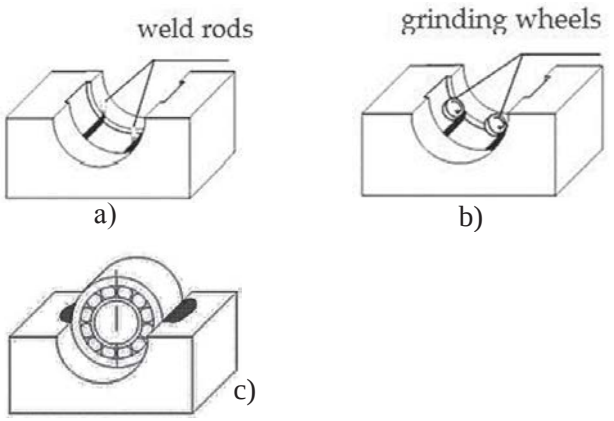
– drying of the surfaces;

– covering a polymer protective coating by virtue of the brush or the trowel.

We also obtained the successful results at restoration of the supporting surfaces under the antifriction bearing. Generally the cantilever load on the gear shaft end portion, provided that if there are the ramp or vibration loadings available, this mostly leads to generation of the "bearing seat" contact area. Generally such generation in form of riffle with depth from 0,5 mm causes the necessity to disassemble the basic part, its sending to welding deposition and postprocessing at the machining workshop. But there is not always an opportunity to remove the equipment from the procedure specification for several days or to dismantle the large-sized basic part. In our practice we managed to restore serviceability of the bearing system by virtue of the composite materials during 1-2 days, namely to the terms ordinary for the current maintenance immediately infield. On figure 2 we show the main phases of such restoration, and they were related to such assembly units as the reducing gear of the blooming mill department dogging crane gripper control mechanism, which is impossible to disassemble, as it was performed together with the whole with the frame (bogie) of the bridge circuit, the support block of the tipping car dumper access platform steering device shaft gear, the table rolls support block and a host of other things.

When it comes to such technology, which involves formation of the supporting surface composite material by virtue of the bearing itself or the smooth template gage, the carrying capacity of such assembly unit meets or exceeds the new one on the two reasons.

The first one is in decrease of the nominal pressures on the contact surface, as the ground bearing ring contacts with the ground restored supporting surface of the case, due to the fact that it is formed, it is shown above, by the bearing outer ring itself. In the standard version of supporting surface performance, obtained after processing with the miller, the ground bearing ring sits on the processed surface micro asperities corners (figure 3) and naturally at even insignificant transient loads these corners are pressed down, and generation of the bearing seat begins.



a) weld deposition of the beacons; b) grinding to the base dimension; c) the bearing installation

Figure 2 – Main phases of supporting surface restoration under the bearing

The second reason is in ability of the composite material to damp the nondestructive impulsive and vibratory loads, which positively effects on prolongation of the supporting surface service life.

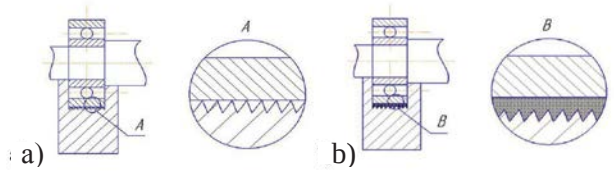


Figure 3 – Standard version of supporting surface performance (a) and version of the supporting surface restoration by the composite material (b)

Key data

As we can see from this list, the work operations on protection will not take much time, and they can be performed during the period of the planned shutdown of the equipment during the current maintenance.

In all the examples listed above, we used the same technique – putting the composite material into the closed space and increasing at its expense its carrying capacity.

Conclusions

Successful utilization of the majority of the assembly units restored by virtue of the industrial equipment composite materials of the shows the broad perspectives of solution of various maintenance problems by such way, the problems that are standing in front of the maintenance manufacturing plants mechanical engineers.

References

1. Shavyrin V.N., Rjazancev V.N. (1981) Kleesvarnye konstrukcii. [Adhesive and welding structures]– 168 p.
2. Kardashov D.A., Petrova A.P. (1983). Polimernye klei: sozdanie i primenenie [Polymer adhesives – creation and application]. – 256 p.
3. Kovachich L. (1985) Skleivanie metallov i plastmass [Adherence of metals and expanded plastics]. 240 p.
4. Ishhenko A.A., Semenjuta A.N., Efimov I.K. (2005). Novye tehnologii vosstanovlenija tjazhelonagruzhennogo prokatnogo oborudovanija[New technologies of the heavy duty rolling mill equipment restoration]// Metall i lit'e Ukrainy [Metal and casting process of Ukraine]. — No 7-8. – P. 61-63.
5. Kormil'cin G.S. (2008). Osnovy diagnostiki i remonta himicheskogo oborudovanija [Fundamentals of diagnostics and maintenance of the chemical processing equipment]/ 120 p.
6. Ermakov V.I., Shein V.S. (1981). Remont i montazh himicheskogo oborudovanija [Maintenance and assembly of the chemical processing equipment]/. – 367 p.
7. G.S. Kormil'cin, O.O. Ivanov (2001).Osnovy montazha i remonta tehnologicheskogo oborudovanija [Fundamentals of assembly and maintenance of the processing equipment]/. – 87c.
8. G.S. Kormil'cin, R.A.Shubin, A.M.Vorob'ev (2009).Diagnostika I remont tehnologicheskogo oborudovanija[Diagnostics and maintenance of the processing equipment]/30 p.