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ADVANCED TESTING IN ROLLING CONTACT FATIGUE FOR WHEEL MATERIAL INVESTIGATION

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Abstract: Presented paper deals with advanced testing in rolling contact fatigue for wheel material investigation for one type of material, which is used for production process of rail wheel rims. These days, there is no EU standard, which would specify rolling contact fatigue test conditions and requirements to the testing equipment. The aim of this paper is present how to measure geometry of the sample through the rolling contact fatigue test. Monitored variables are width of the contact path in the transversal direction, plastic deformation in the transversal direction and radial direction. Chosen interesting results obtained on own experimental equipment are presented.

Keywords: twin-disc test, wear resistance, rolling contact fatigue.

1 Introduction

Thanks to emphasis to low price, long lifetime and increasing traveling speeds on railway there is emerging requirement how to investigate contact fatigue for wheel material at the lowest price. A lot of engineers examines materials and they are using different methods to get the most similar results as in real conditions. One of the method is so called twin-disc test, which article also deals with [1], [2]. This test is used as a standard experiment to analyse wear resistance in rolling contact or resistance to contact fatigue. Nowadays a lot of authors has been using 2D scanning of surface of specimens under different conditions as are sand in contact, wet contact and more [3], [4], [5]. Despite the progress in methods, the authors in most cases do not include change of contact pressure causing by change of contact path width and diameter of samples by permanently deformation in dependence of number of cycles and loading force. The change of contact pressure is known from the past [6]. This neglect of change of maximum of contact pressure can cause distorted results, which are moving away from reality. Proposed paper deals with problematic how to use 2D laser profilometers to scan contact path width (Figure 1 - left). The results point to the fact that results from 2D measurement by laser profile sensor can be used not only for contact pressure control, but also to investigate surface changes.

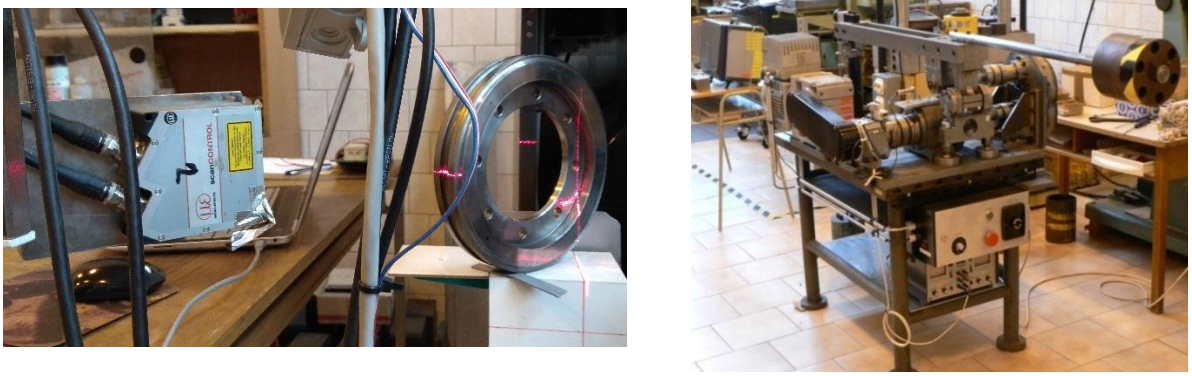

Figure 1 – Measurement of contact path width (left) and TUORS II twin-disc experimental rig (right)

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All experiments in this study have been realized on twin-disc experimental rig called TUORS mark II (Figure 1 - right), designed in cooperation of VŠB-TU Ostrava and Bonatrans Group.a.s company. The new online measurement approach brings better possibilities to precise results of tests than previously applied approaches [6].

2 Test conditions

Authors focused on Class C material investigation. The creepage between the wheel disc and rail disc was 0.75%. The maximum Hertz contact pressure was equal to 1800MPa. This set carried out 60000 cycles. Diameter of wheel rim specimen is equal to 82,5mm and diameter of rail specimen is 215,5mm. Initial width of both specimens is 4,1mm. Both of specimens were measured by laser profile sensor made by company Micro-epsilon, type ScanControl 2900-100, where exposure time was set to 1ms for rail specimen and 25ms for wheel specimen.

3 Results

Figure 2 shows transverse profiles of wheel and rail specimen after 60 000 cycles, which was measured by laser profile sensor. From measured profiles, it can be assumed that the machine was not too rigid and it caused a tilt, but it does not affect the results.

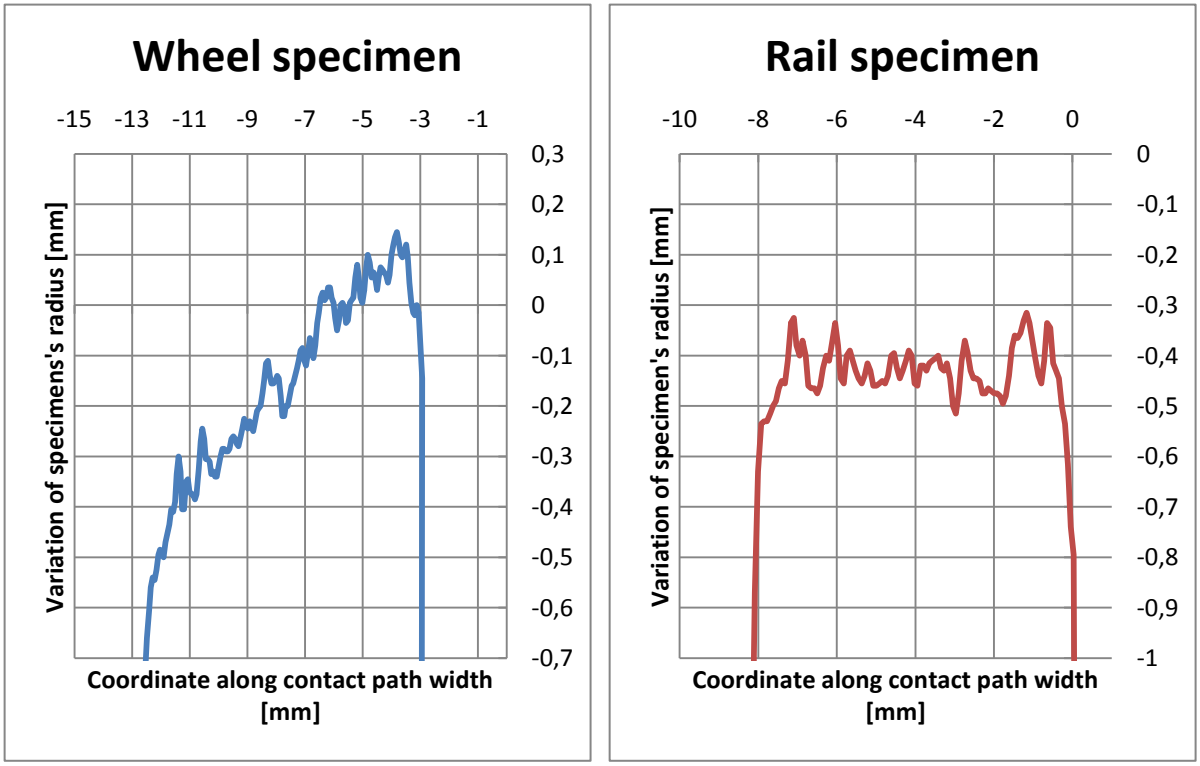

Figure 2 – Transverse profiles for Wheel and Rail specimens after 60000 cycles obtained by use of laser profile sensor

4 Conclusion

Presented results and findings point to the possibility of 2D laser profile sensor application to can be used in the first case for comparison different materials under same conditions in the second case for another many explorations of behaviour of material during the test as many authors do that. With appropriate adjustment of testing rig it can serve for testing with sand or something else Presented paper demonstrates method of measuring the contact path width, which is appropriate for measuring in

real-time during the test. On the other hand, the incorporation of that method to ensure stable contact pressure during the test will need to treat also other issues. The choice of appropriate method for contact pressure computation plays a crucial role too.

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