UDC 621.923.9

RESEARCH OF VIBRO-ABRASIVE PROCESSING FEATURES OF INTERNAL SURFACES OF PARTS

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The paper considers vibro-abrasive processing of internal surfaces of parts. The key problem raised in the paper is insufficient research of the influence of parts dimensions on the vibro-abrasive processing. The experimental research using different abrasive media, different dimension and mass of samples is presented. It is established that the roughness of the internal surface is worse than the external one in 1.15 – 1.25 times. Thus, parts dimension influence roughness only with prismatic media, with porcelain media part dimension has no affect.

Keywords: vibration, vibro-abrasive processing, abrasive media, surface roughness, internal surfaces

УДК 621.923.9

ИССЛЕДОВАНИЕ ОСОБЕННОСТЕЙ ВИБРОАБРАЗИВНОЙ ОБРАБОТКИ ВНУТРЕННИХ ПОВЕРХНОСТЕЙ ДЕТАЛЕЙ

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Исследована обработка внутренних поверхностей деталей при виброабразивной обработке (ВиАО). Рассмотрена проблема недостаточного исследования влияния размеров деталей на процесс ВиАО. Проведены эксперименты с использованием различных сред и заготовок. Шероховатость внутренней поверхности хуже, чем наружной приблизительно в 1,15–1,25 раза. Размер образцов влияет на шероховатость при обработке в призмах, а в фарфоровых шарах практически нет.

Ключевые слова: вибрация, виброабразивная обработка, абразивная среда, шероховатость поверхности, внутренние поверхности.

Introduction. Mechanical engineering is one of the actively developing industries. More and more requirements are imposed on the quality of parts. One of these requirements is the surface roughness. Growing interest presents vibro-abrasive processing (ViAP) as a promising method of finishing. Great interest to this method of processing is caused by significant technical capabilities, as well as ease of processing [1]. Despite numerous studies, many issues remain unresolved, which holds back the introduction of ViAP into large-scale production.

Aim of research: Research vibro-abrasive processing features to internal surfaces of parts

Objectives:

1. Experimentally identify the influence of part dimension on the roughness of internal and external surfaces
2. Compare the roughness of internal and external surfaces

Vibro-abrasive finishing is a mechanical or chemical-mechanical process of removing the smallest particles of metal from the workpiece surface, making an oscillatory motion in the process of work (Fig. 1). [2]

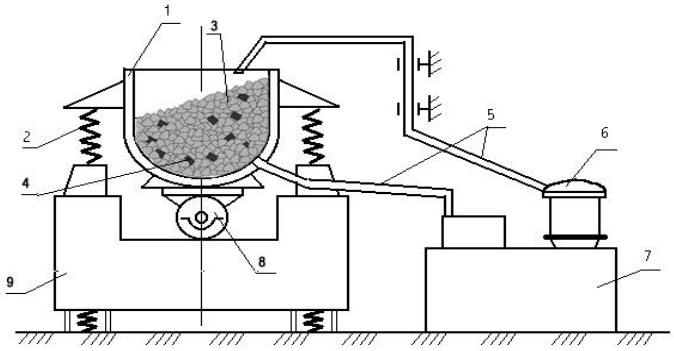

Fig. 1 Vibro-abrasive finishing

1 – work chamber; 2 – springs; 3 – abrasive media; 4 – workpiece; 5 – pipes for process fluid; 6 – pump; 7 – tank for fluid; 8 – unbalance vibration motor; 9 – bed

Samples (Fig. 2) are immersed in the work chamber with abrasive media. The camera makes oscillatory movements in various directions. The processing is performed with the supply of the process fluid, ensuring washing and protection parts from corrosion. [3]

Main body. Literature review in the field of ViAP showed that the processing of the internal surfaces is not well investigated. Roznenko's thesis [4] presents the results on the processing of internal surfaces (flat and cylindrical), introduces a new surface location factor, and also presents a method for determining this coefficient, but the empirical dependencies cover a narrow range of materials and processing modes.

Fig. 2 Experimental samples steel 30CrMnSiA

Samples, after rough turning operation, with dimensions D = 35mm, d = 30mm and H_1=20mm, H_2=40mm, H_3=60mm were processed with aggressive deburring abrasive media (Fig. 3) The second stage was processed with 15x15 triangular prisms, 16 grit (Fig. 4) and porcelain media diameter 5 mm (Fig. 5). [5] In order to prevent corrosion a solution of soda ash was used as a process fluid.

Fig. 3 Aggressive deburring media, rit 25

Fig. 4 Triangular prisms 15×15, grit 16

Fig. 5 Porcelain media diameter 5 mm

The mass was measured on an analytical balance AD 200 (Fig. 6). A portable profilometer model SURFTESTSJ-210 (Fig. 7) was used to measure the surface roughness.

Fig. 6 Analytical balance AD 200

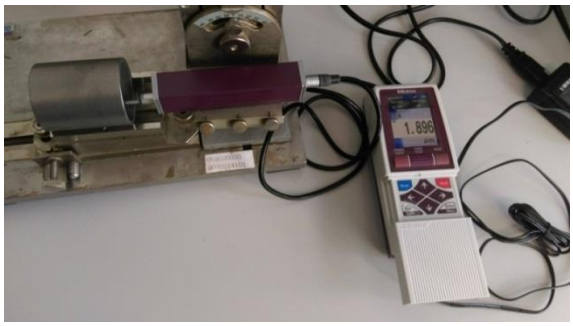

Fig. 7 Portable profilometer SURFTESTSJ-210

Based on obtained results, graphs of internal and external surface roughness during processing time were plotted. The blue color shows roughness of external surface, orange – internal surface.

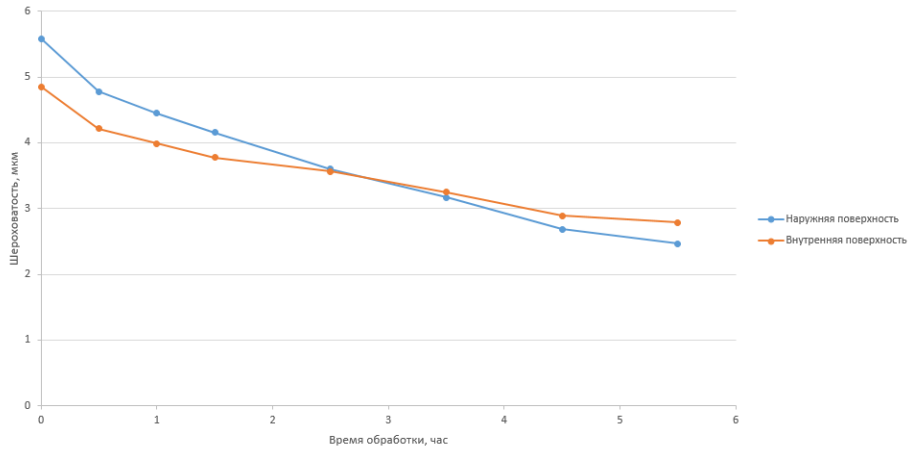

Fig. 8 Graph of changing roughness during processing time, triangular prisms, sample length 20

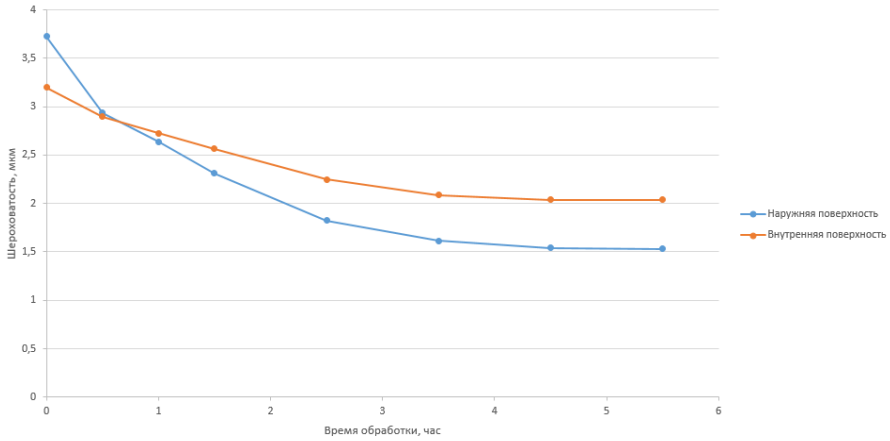

Fig. 9 Graph of changing roughness during processing time, triangular prisms, sample length 40

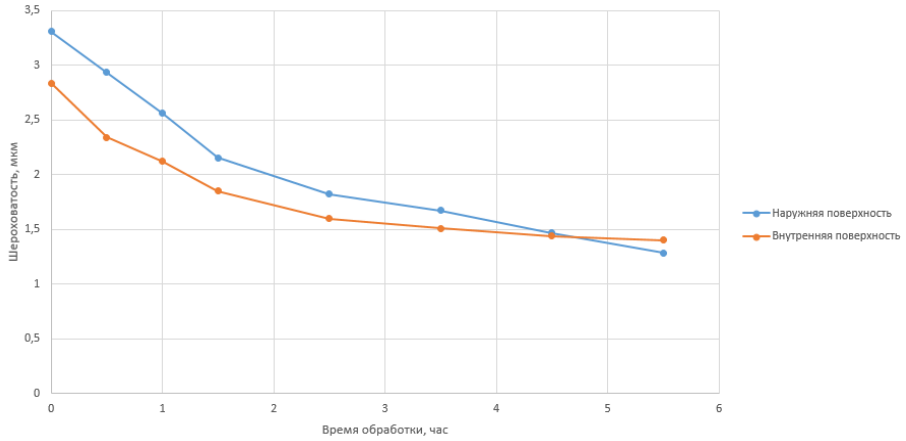

Fig. 10 Graph of changing roughness during processing time, triangular prisms, sample length 60

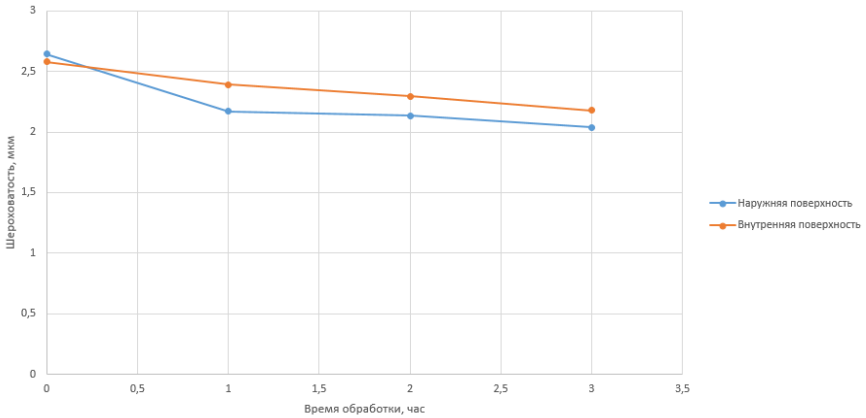

Fig. 11 Graph of changing roughness during processing time, porcelain media, sample length 20

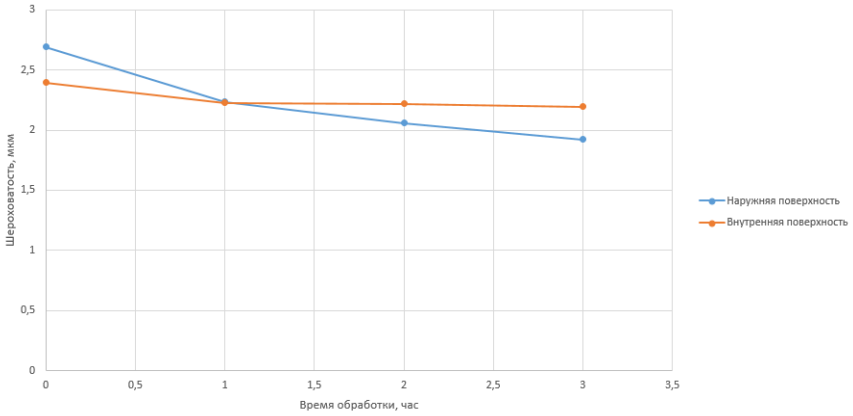

Fig. 12 Graph of changing roughness during processing time, porcelain media, sample length 40

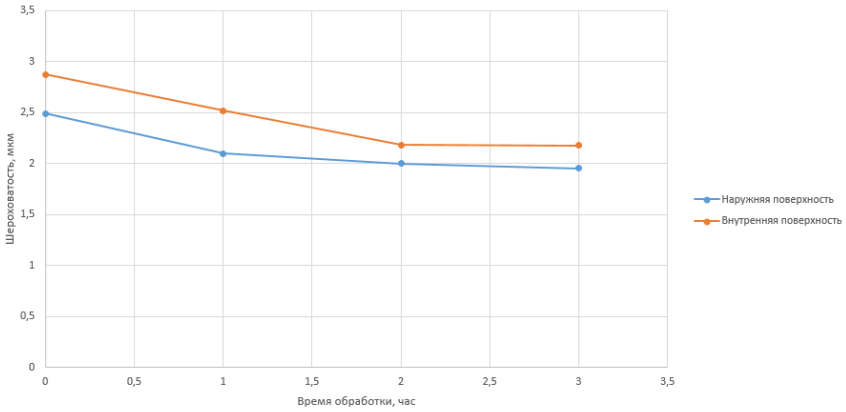

Fig. 13 Graph of changing roughness during processing time, porcelain media, sample length 60

Conclusion

Thus, analyze the results of experimental research, it is clear:

1. Internal surface roughness is worse than the external approximately 1,15 – 1,25 times
2. Sample dimension affects the roughness with triangular prismatic media processing, with porcelain media sample dimension has no affect.

The assumptions put forward to explain the differences external and internal surface roughness:

1. It is known that increasing intensity of processing, the surface roughness deteriorates, it is assumed that for internal surfaces, due to insufficient impulse of interaction abrasive granule with surface, the positive skewness are poorly removed
2. The part itself gives an impulse to the granules during processing, which causes a worse roughness of the internal surface compared to the external

This subject requires further study and more experiments using different materials of parts and processing modes.

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