Cavitation erosion of electrostatic spray polyester coatings with different surface finish

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Abstract. Polyester coatings are among the most commonly used types of powder paints and present a wide range of applications. Apart from its decorative values, polyester coating successfully prevents the substrate from environmental deterioration. This work investigates the cavitation erosion (CE) resistance of three commercial polyester coatings electrostatic spray onto AW-6060 aluminium alloy substrate. Effect of coatings repainting (single- and double-layer deposits) and effect of surface finish (matt, silk gloss and structural) on resistance to cavitation were comparatively studied. The following research methods were used: CE testing using ASTM G32 procedure, 3D profilometry evaluation, light optical microscopy, scanning electron microscopy (SEM), optical profilometry and FTIR spectroscopy. Electrostatic spray coatings present higher CE resistance than aluminium alloy. The matt finish double-layer (M2) and single-layer silk gloss finish (S1) are the most resistant to CE. The structural paint showed the lowest resistance to cavitation wear which derives from the rougher surface finish. The CE mechanism of polyester coatings relies on the material brittle-ductile behaviour, cracks formation, lateral net-cracking growth and removal of chunk coating material and craters' growth. Repainting does not harm the properties of the coatings. Therefore, it can be utilised to regenerate or smother the polyester coating finish along with improvement of their CE resistance.

Key words: polyester powder coatings; cavitation erosion; profilometry; spectroscopy; wear mechanism; AW-6060 aluminium alloy.

1. INTRODUCTION

Continuous demand for increasing wear resistance of engineering components stimulates the development of organic and polymer coating systems and motivates the research into broadening the application of engineering materials [1–3]. Metallic and polymer materials performance is increased using surface engineering technologies and coatings deposition [3–6]. Generally, the coating is the outer layer of the material, produced in a natural or artificial way and differing from it in terms of its physicochemical properties or structure [7, 8]. Electrostatic spray polyester coatings are among the most commonly used types of paints [9]. They are characterised by good corrosive and mechanical properties. The widespread use of polyester coatings is linked with such advantages as relatively simple technology, reasonable price, satisfactory resistance against various environmental interactions, high quality surface, including aero- and hydrodynamic smoothness, and last, but not least – aesthetic features.

The durability of paint coatings depends on the material aging properties, resistance to mechanical factors and the degree of environmental aggressiveness [10, 11]. Application of pro-

tective polyester based coatings systems is a promising candidate to prevent elements of machines and devices operating in conditions of abrasive [12], erosive [13], and corrosive [14] deterioration, it seems an effective technique for increasing the durability of elements in different industrial sectors [15]. The protective polymer-based coatings allow combining the advantageous properties of deposited layer and substrate. Moreover the cost of regenerating elements of devices and machines is usually much lower than manufacturing, it is a practice often used in industry [16]. Regeneration by second layer deposition, in addition to restoring functional properties, can simultaneously increase the durability of the protected objects even several times. Still, the coatings with regenerated layer or double-layer systems of polymer coatings are not sufficiently discussed in the current papers.

Due to good mechanical properties, low density, corrosion resistance, good thermal, and electrical conductivity, aluminium alloys are an important construction material in the aviation, automotive, shipbuilding, chemical and food industries, but also in construction and architecture. Unfortunately, general aluminium alloys wear behaviour is considered as relatively poor [17, 18]. The application of polymer coatings is considered an easy for deposition and cost-effective idea for increasing the operation time of aluminium based structures. Aluminium components can be easily covered by electrostatic deposition of coatings. Deposits made of powder feedstock based

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on polyester resin are usually used as a coating material for civil engineering purposes. These structures can be cleaned by high-pressure water fluids, and the cleaning process can result in appearance of erosive droplet impingement or cavitation wear. Consequently, polyester coatings can be damaged. However, the water droplet impingement erosion and CE resistance of electrostatic spray polyester coatings seems not sufficiently discussed by the up-to-date literature.

Moreover, the main deterioration processes present in fluid machinery are corrosion, erosion by solid particle, erosion by liquid (water droplet impingement erosion) and erosion by fluid namely, CE. Many research papers are referring to the corrosive and solid particle erosion of organic coatings, in turn, the droplets and CE studies are limited. It is known that polyester coatings cannot easily compete with such polymer and composite products like Belzona, MetalClad, CeramAlloy, or FLEXICLAD, Duratough. Moreover, the authors are aware about PVD (physical vapor deposition), HVOF (high velocity oxy-fuel) and other highly advanced technologies for anticavitation coatings deposition. Therefore, polyester coatings can be hardly recommended as a protection against CE of hydraulic machinery and equipment while they can be recommended for protection against mild CE or regeneration of slightly damaged surfaces like yacht hulls or motor-boat rudders.

Despite the fact that the cavitation damage of plastics is described by scientific papers [19–21], there is especially little literature focusing on polyester materials. Moreover, the erosion mechanism is well discussed for epoxy-based materials [22, 23] but not for polyester electrostatic spray coatings. Generally, the literature referring to the CE resitance of polyester materials is scant. Exemplary, Hibi *et al.* [24] investigated epoxy, unsaturated polyester, Polycarbonate, and acrylic resin. Tests were conducted under various tensile stress conditions (Tensile-Cavitation test) using ASTM G32 procedure however, the relationship between stress and erosion initiation time has not been stated. Besides, it was noted that the samples manufacturing process (moulding) of the polymers (epoxy resin) generates material nonuniformities which affect the wear resistance of the polymers. Authors stressed that initial mixed voids and micro cracks by CE resulted in macroscopic cracks. Furthermore, polymer-based materials CE resistance is compared with the resistance of metallic structures. In the Taillon *et al.* work [25] the fibre reinforced composite material (polyallylate fibre, commercially registered as "Vectran", chemically it is an aromatic polyester) was investigated using a cavitating jet apparatus inspired by the ASTM G134 standard. It is reported that the erosion rate of Vectran is close to that of aluminium alloy (A7075), but compared with SUS304 stainless steel and aluminium bronze, the erosion rate of the composite material is significantly higher. Summing up, the literature survey indicates limited data about CE damage mechanism of electrostatic sprayed polyester coatings.

Moreover, damaged polyester coatings can be renovated by repainting. Taking into consideration the proposed fluid-environment operation of polyester coatings, it is worth to investigate the effect of repainting on the functional properties of coatings. It can be done especially by conducting CE or wa-

ter droplet impingement erosion tests. Besides, the literature survey indicates scant information about the CE mechanism of polyester coatings with different coatings finish. This work fills the lack of knowledge regarding CE testing of electrostatic deposited polyester coatings.

The goal of this study was to investigate the CE resistance of electrostatically sprayed polyester coatings. The results were compared with those of the reference sample manufactured of AW-6060 aluminium alloy. Also, the effect of repainting on CE was investigated. The three different surface finish coatings (matt, silk gloss, and fine structure surfaces) damage mechanisms were compared. The effect of cavitation on polyester coatings structure development was examined using FTIR spectroscopy and the wear mechanism was analysed basing on SEM (scanning electron microscopy) and profilometry.

2. MATERIALS AND METHODS

2.1. Materials
The current work focuses on the research of three types of polyester powder paints consisting of single- and double-layers (repainted) deposited using electrostatic spray onto the aluminium base, grade EN AW-6060 (AlMgSi), marked as B. This is a typical alloy used as a substrate in real-life application of electrostatic spraying of polyester coatings. The preparation details are given in our previous work [16] while sample names are given in Table 1. Three commercial polyester powder coatings were deposited: IGP-DURA® face 5803 (marked as M), IGP-DURA® face 5807 (marked as S) and TIGER Drylac®Series 29 (named as R). The samples covered with a single layer of paint were marked with the symbols M1, S1 and R1 and with a double layer of paint (electrostatic spray repainted) were marked as follows M2, S2 and R2. Deposited electrostatic powder coatings differ in thickness, finish and consequently with surface morphology, see Table 1.

Table 1
Sample description and selected coatings properties

Sample code	Sample code acc. to [16]	Layer	Thickness, μm	Coating surface finish
M1	1.1	single	60–110	Matt
M2	1.2	double	130–210	
S1	2.1	single	60–90	Silk gloss
S2	2.2	double	100–150	
R1	3.1	single	60–140	Fine structure, matt
R2	3.2	double	170–260	

2.2. Methods
This study continues the research previously published in the paper [16] where the surface morphology, cross-section microstructure and coatings mechanical properties such as cupping, bending, impact, adhesion to substrate tests were examined for single and double layer polyester coatings. In the current work we employed the IR-spectroscopy, optical profilometry, SEM microscopy to evaluate the CE of polyester coatings.

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IR-spectroscopy. The FTIR spectroscopy is a very efficient and cost-effective method for identifying the chemical structure of organic materials. This analysis is based on the study of the intensity and position of the spectral bands characteristic for the functional groups present in the molecule. The location of the bands is closely related to the molecular structure of the tested materials [26, 27]. The aim of the research was the chemical characterization and observation of the effect of the cavitation process on the chemical structure of the tested polyester paints. The tests were performed using the ATR (attenuated total reflectance) technique. The ATR spectra of the surface layer of the tested samples were recorded using an attachment with a diamond crystal. A Thermo Nicolet 8700 FTIR spectrometer with a Smart Orbit™ diamond ATR attachment and a DTGS (deuterated triglycine sulphate) detector was used to record the spectra. The tests were carried out in the wavenumber range 4000–400 cm^{-1} and spectral resolution of 4 cm^{-1}. Spectra were recorded at room temperature, directly from the surface of the samples. ATR spectra were subjected to ATR correction, baseline correction and scaled normalization.

Microscopic analysis. In order to characterise the surfaces of polyester coatings, the tests of the obtained polyester coatings were performed using scanning electron microscopy (SEM). Particular attention was paid to the surfaces' morphology depending on the number of applied layers. The tests were carried out using a scanning electron microscope Quanta 3D FEG (FEI). Microscopic images were taken at 5.00 kV with an EDT detector. There were the following magnifications: ×2500 and ×10000 applied. In order to analyse surface damage, the observations were performed before and after the cavitation process using the SMZ 1500 optical microscope (Nikon) and Phenom-World ProX microscope (SEM), with back-scatter electron mode with 10 kV accelerating voltage of electron beam penetration.

Optical profilometry. The optical profilometry analyses were performed using the Countour GT-K1 optical profilometer (Veeco) based on the VXI technique with the 5× magnification lens. Surface microgeometry maps were examined in the area of 2.3 mm × 1.7 mm. The surface tests were carried out for single and double layers of polyester coatings before and after the cavitation process. The roughness parameters such as arithmetic mean deviation (R_a), root mean square deviation (R_q), maximum peak to valley (R_t) of the profile were determined according to literature and ISO 4287 standard recommendations [28–30].

Standard Test Method for Cavitation Erosion. The cavitation resistance tests were carried out in accordance with ASTM G32 [31] using stationary specimen method described elsewhere [32]. The gap between the sonotrode and the sample was set at 1 ± 0.05 mm. The distilled water was maintained at 24 ± 2°C temperature, and gas content was stabilised for 30 minutes before testing. The total test time lasted 10 minutes. The samples were weighed with accuracy of 0.1 mg after the following exposure time intervals: 1, 3, 6 and 10 minutes. To calculate the erosion, depth of polyester-based samples and AW-6060 aluminium alloy (reference sample), density of 1.5 g/cm^3 and 2.7 g/cm^3 was used, respectively. Cumulative erosion rate curves

were estimated by dividing the cumulative erosion rate at a specified point in the erosion test by the corresponding cumulative exposure duration. After the test, the erosion mechanism was examined using SEM.

3. RESULTS AND DISCUSSION

In the previous study, the electrostatic powder coatings microstructure, roughness, and mechanical properties were compared in case of the single and double layer electrostatic polyester coatings [16]. The study states that polyester coatings consist of polymeric resin (binder) and the "particles" corresponding to pigments or additives. Moreover, repainting does not affect roughness, interlayer adhesion and microstructure uniformity, however it decreases the impact resistance of all tested polyester coatings. Furthermore, the mechanical properties of R-type coatings were lower than those of M and S coatings. Both fine structure coatings (R1 and R2) present lower coupling results, poor bending ability and it seems that repainting decreased the elasticity of R2 coating.

3.1. Cavitation erosion (CE) resistance

The comparison of the results obtained for substrate and single and double layer electrostatic polyester coatings is presented in Figs. 1–3. It confirms that all tested coatings usefully diminish the damage of aluminium substrate. It is known from the literature that the aluminium alloys usually present relatively poor CE resistance [33, 34] and this study confirms that elec-
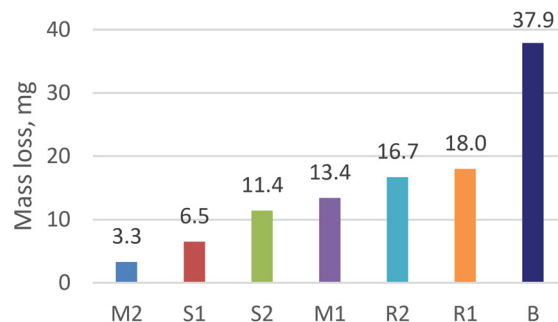

Fig. 1. Comparison of mass losses of polyester coatings and AW-6060 aluminium sample (marked as B), 10 minutes of cavitation process
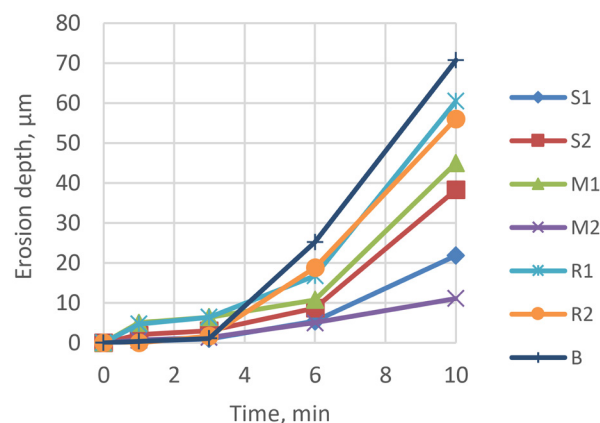

Fig. 2. Mean depth of erosion curves

trostatic deposited polyester coatings mitigate the aluminium substrate damage. Polyester coatings present lower cumulative loss (Fig. 1) and mean erosion depth (Fig. 2) than reference aluminium alloy. The highest CE resistance was obtained for M2 coating.
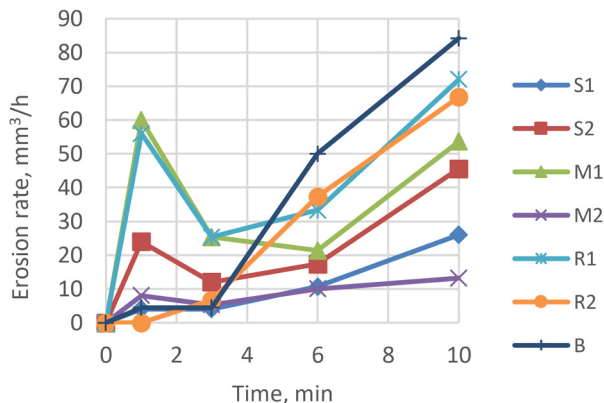

Fig. 3. Cumulative erosion rate curves

On the other hand, the R1 coating presents more than five times higher mass loss than M2 coating. The repainting does not act beneficially in case of S2 coating, in the case of R2, the second layer slightly decrease the mass loss while deposition of the second layer onto almost 4 times increased the wear resistance of M2 polyester coating. S and M type coatings present higher erosion resistance than R coatings. Analysis of erosion curves indicates that aluminium alloy incubation period lasts for 3 minutes, and further erosion accelerates with higher erosion rate than for polyester coatings (Fig. 3). The incubation period of the coatings lasts 3 to 5 minutes and after that, the erosion accelerates. The M2 coating exhibits the lowest cumulative erosion rate (13.2 mm^3/h) which was almost 2 times those noted for S1 (26 mm^3/h), Fig. 4. Erosion rate of other samples presents more than 50 mm^3/h (for coatings) and the highest value of 84.2 mm^3/h was noted in the case of aluminium.

3.2. The CE performance of coatings

The microscopic examination showed development of the examined materials surface as a result of the cavitation process. The optical microscopy suggests different coating material degradation, see Fig. 4, and limited material flake off was observed for M2 coatings. Other coatings present high rate of detachment. The profilometry analysis (Fig. 5 and Fig. 6) confirmed different tested samples initial surface finish. Samples R1 and R2 are significantly rougher than M1, M2, S1 and S2 which are characterised by a much more homogeneous surface morphologies. S-type coatings roughness was at the comparable level with the reference aluminium sample (Table 2 and Table 3). Overall, apart from the M2 sample, substrate exposure was clearly seen in Fig. 4. Thus, M2 adheres well to aluminium substrate and undergoes severe surface roughening. The other polyester coatings were partly removed which facilitates the aluminium substrate erosion (see Fig. 4). Wear mechanism of the aluminium alloys differs from erosion mechanism
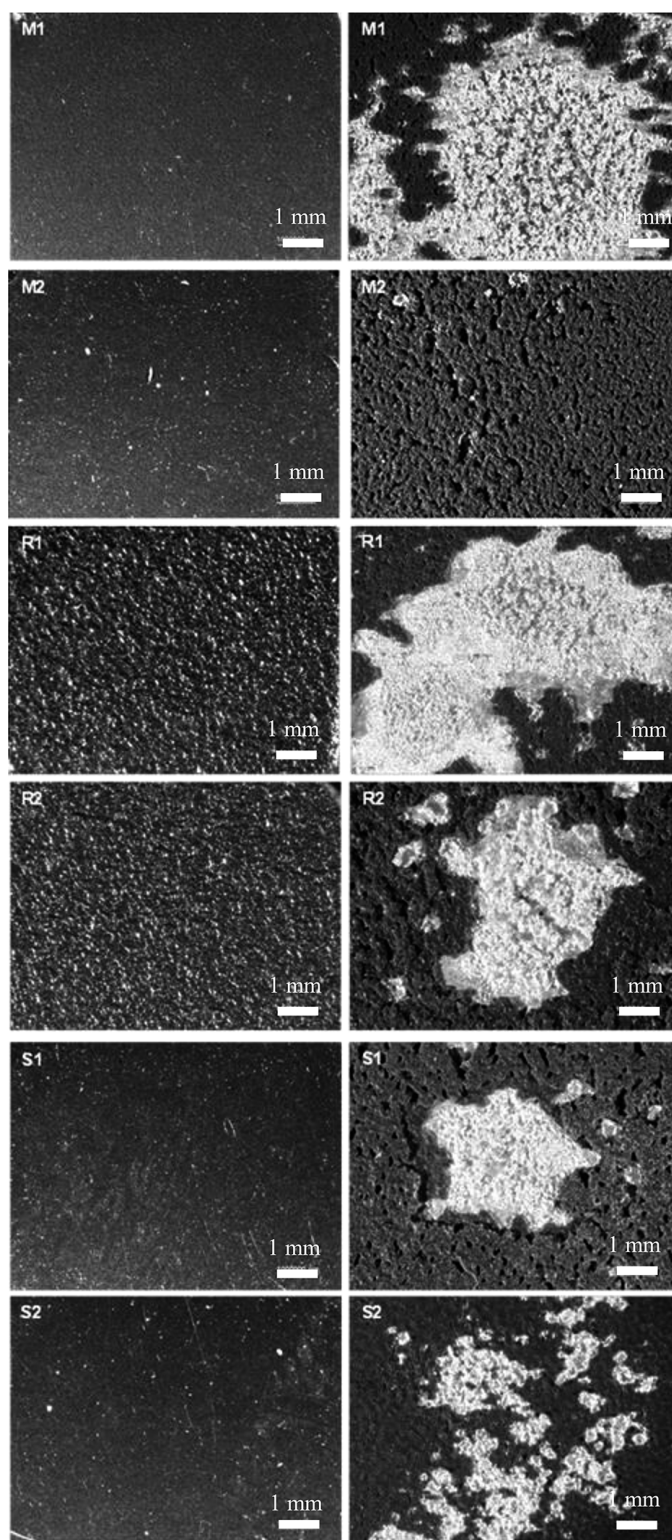

Fig. 4. Surfaces before (left) and after the cavitation process (right)

of polyester coatings. Overall aluminium alloys damage mechanism relies on plastic deformation of Al-rich solid solution and removal of deformed material [18, 35, 36].

The results of the CE resistance of materials are usually affected by the surface morphology and it is generally claimed that the surface uniformity acts beneficially for resistance to CE

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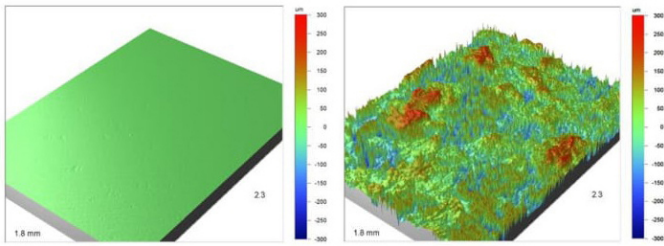
Fig. 5. Microgeometry maps of base: before (left image) – B1 and after the cavitaton erosion (right image) – B1-k (vertical scale ragne 300 um)

Table 2
Roughness of the base material B (aluminum alloy) before and after cavitation erosion testing (marked as B1-k)

Base	B1	B1-k
Roughness parameters	$R_a = 0.33$ μm	$R_a = 66.83$ μm
	$R_q = 0.44$ μm	$R_q = 82.67$ μm
	$R_t = 17.41$ μm	$R_t = 460.65$ μm

Table 3
Roughness of polyester coating before and after (name ended with "-k") cavitation erosion testing

Polyester coating	M1	M1-k	M2	M2-k
Roughness parameters (μm)	$R_a = 1.09$	$R_a = 22.5$	$R_a = 1.16$	$R_a = 12.12$
	$R_q = 1.34$	$R_q = 27.54$	$R_q = 1.50$	$R_q = 19.70$
	$R_t = 22.17$	$R_t = 318.92$	$R_t = 13.79$	$R_t = 263.24$
Polyester coating	R1	R1-k	R2	R2-k
Roughness parameters (μm)	$R_a = 6.65$	$R_a = 12.97$	$R_a = 4.87$	$R_a = 28.58$
	$R_q = 9.07$	$R_q = 18.73$	$R_q = 6,71$	$R_q = 36.31$
	$R_t = 157.51$	$R_t = 265.49$	$R_t = 82.45$	$R_t = 308.50$
Polyester coating	S1	S1-k	S2	S2-k
Roughness parameters (μm)	$R_a = 0.45$	$R_a = 14.07$	$R_a = 0.34$	$R_a = 26.82$
	$R_q = 0.56$	$R_q = 21.21$	$R_q = 0.43$	$R_q = 34.50$
	$R_t = 18.54$	$R_t = 306.38$	$R_t = 11.28$	$R_t = 277.57$

[37, 38]. The tested polyester coatings R1 and R2 are characterised by significantly higher surface roughness compared to the samples M1, M2, S1 and S2. The arithmetic average roughness for a single layer of paint is $R_a = 6.65$ μm. The tests also exhibited that after application of the second paint layer, the surface roughness decreased to $R_a = 4.87$ μm. An analogous situation was observed for the paints S1 and S2. The roughness parameters decreased after the second paint layer application. The arithmetic average roughness was reduced from $R_a = 0.45$ μm to $R_a = 0.34$ μm. The maximum height of the profile also decreases significantly from $R_t = 18.54$ μm to $R_t = 11.28$ μm. In contrary to previous 2D measurements it seems that 3D optical profiler analysis confirms that repainting smooths the coating finish and decreasing the R_t parameter.

The tests based on the optical profilometry were also aimed at observing the surface and determining the roughness parameters after the cavitation process. They showed an increase in the roughness parameters of all tested samples after the cavitation process. It was observed for both single and double paint layers.
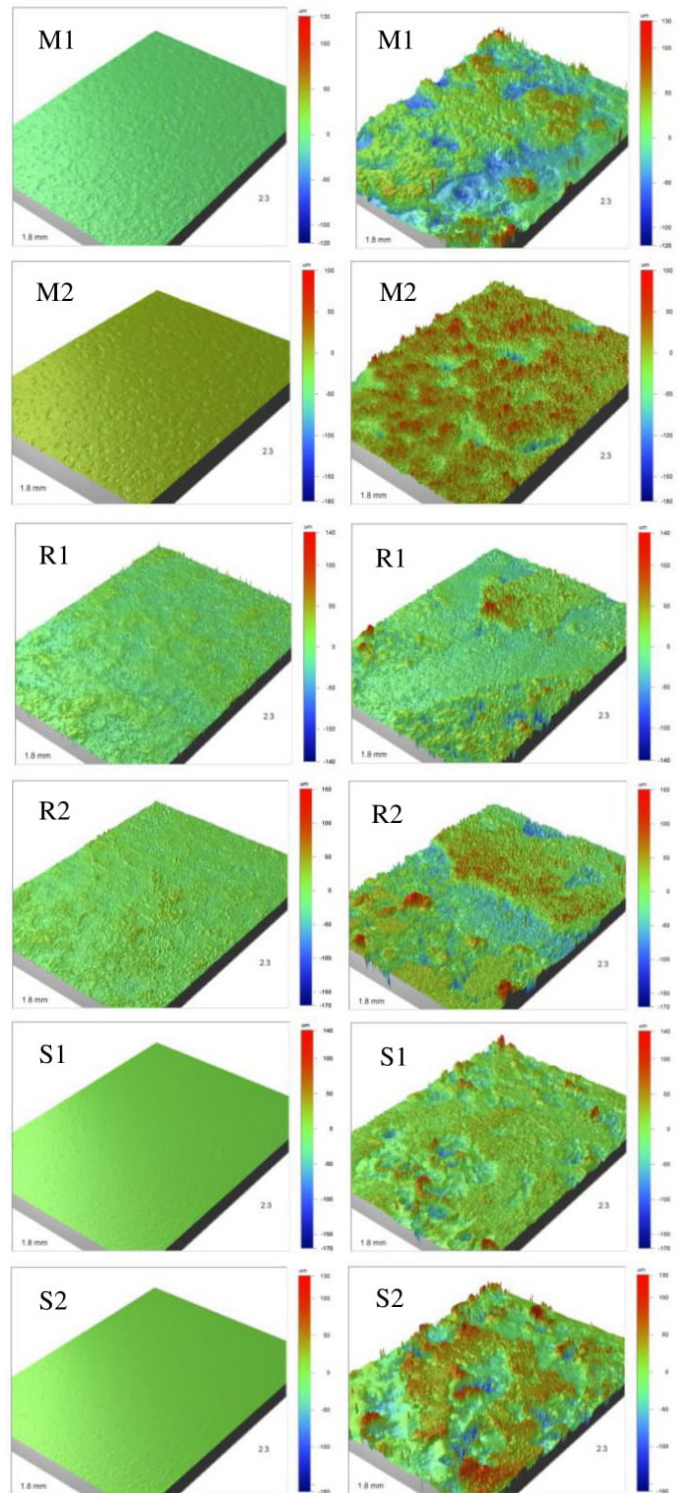
Fig. 6. Microgeometry maps before (on the left) and after (on the right) the cavitation erosion (different vertical scale ranges)

Generally, the initial surface finish affects the CE resistance. Therefore, the roughest R-type coatings present severe cavitation damage. Although no correlation between the initial absolute surface roughness R_a, R_q and R_t and CE indicators were confirmed, a relationship between the cavitation damage and increase of R_t roughness parameters was signalised. It seems

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that the coatings which present higher mass losses display much uniformity and less roughening of damaged area. This can be a result of coatings flake off and aluminium substrate exposure (Fig. 7).
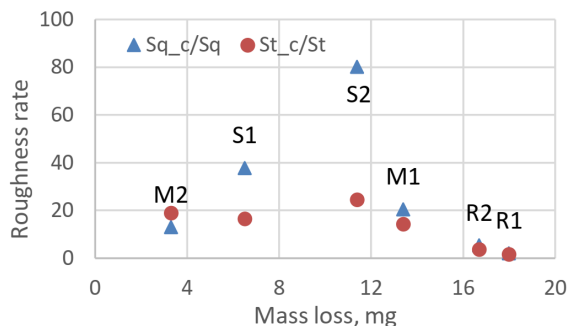

Fig. 7. The change rate of the surface roughness R_q and R_t parmeteres due to cavitation (estimated for coatings)

For the chemical characterisation of 3 polyester coatings FTIR-ATR spectra were analysed. The spectra show the specimens for single and double polyester coatings. Figures 8–10 present the FTIR spectra made by the ATR technique of the polyester paints tested before the cavitation. The tests showed no differences in the FTIR-ATR spectra of polyester paints depending on the number of applied layers (Figs. 8–10). In the FTIR-ATR of the spectra samples M1, M2, R1, R2, S1 and S2 before the cavitation process, the bands in the range 2970–2850 cm^{-1} were observed. They correspond to the stretching vibrations of the C-H groups. At the wavenumbers in the 1760–1690 cm^{-1} range, an intense band corresponding to the stretching vibrations of the C $=$ O groups characteristic of ester compounds occurred. The spectra also showed the presence of intense bands corresponding to the stretching vibrations of the
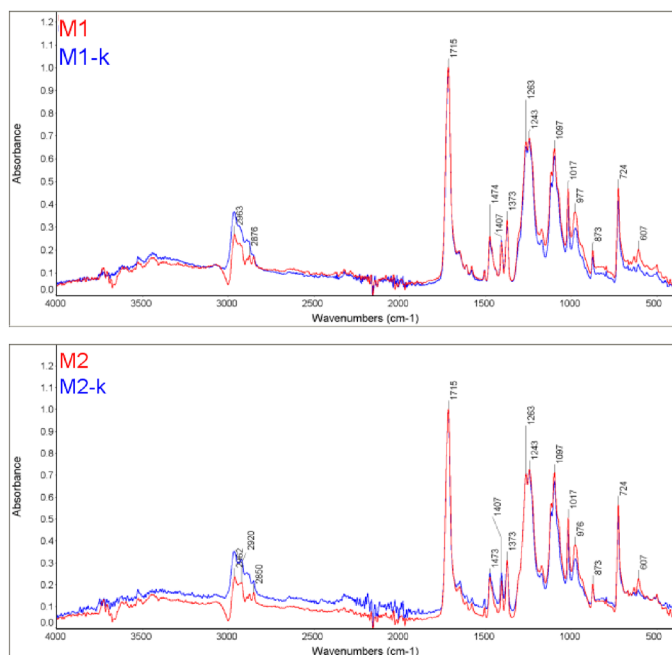
Fig. 8. The FTIR-ATR spectra of the samples M1 and M2 before and after the cavitation marked as M1-k and M2-k
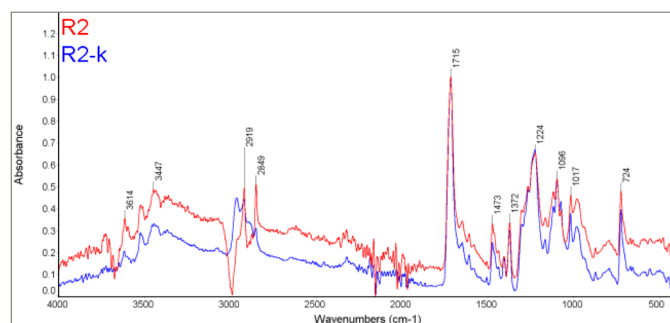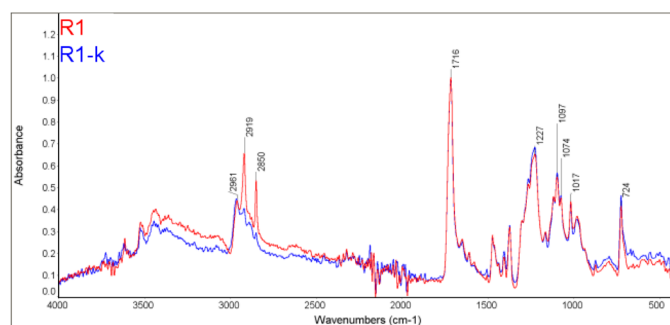
Fig. 9. The FTIR-ATR spectra of the samples R1 and R2 before and after the cavitation marked as R1-k and R2-k
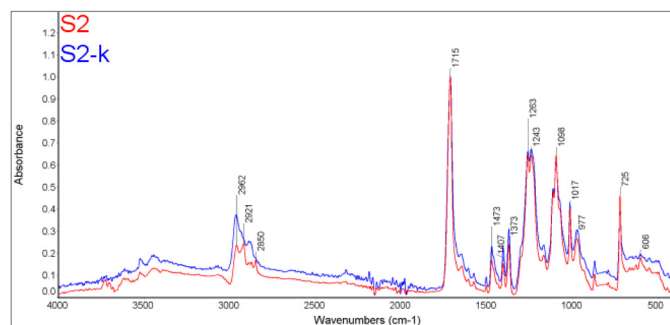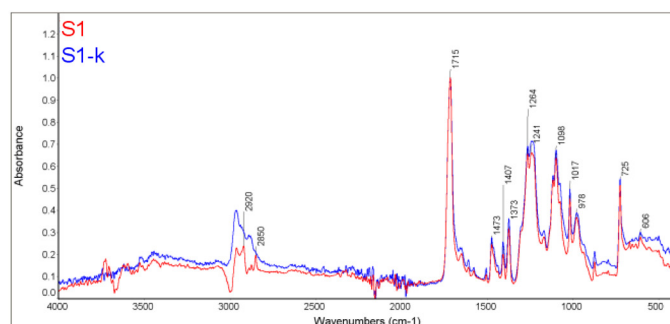
Fig. 10. The FTIR-ATR spectra of the samples S1 and S2 before and after the cavitation marked as S1-k and S2-k

C-O groups in the range of 1300–1050 cm^{-1}. These bands are also characteristic of ester compounds. In the FTIR-ATR spectra, the bands in the range of the wavenumbers 730–675 cm^{-1} corresponding to the non-planar deformation vibrations of C-H groups were also observed [39–41]. Spectroscopic studies also suggest the highest contents of O-H groups in the R1 and R2 samples as evidenced by the most intense band in the range of the wavenumbers 3650–3200 cm^{-1}. Summing up, the re-

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painting process does not change the FTIR-ATR spectra of each polyester coating.

The spectroscopic investigations after the CE process showed the presence of bands characteristic of the tested polyester paints. The conducted analyses also showed differences in the signal intensity in the case of matt and silk gloss paints in the wavenumber range 2970–2850 cm^{-1}, corresponding to the C-H stretching vibrations. Besides, such changes seem to most visible in case of the R2 sample (Fig. 9). This may indicate the breakdown of polymer chains due to cavitation.

3.3. Cavitation erosion mechanism

SEM (scanning electron microscopy) examinations of deposited coatings and the eroded polyester coatings due to the cavitation process are shown in Figs. 11 and 12, respectively.
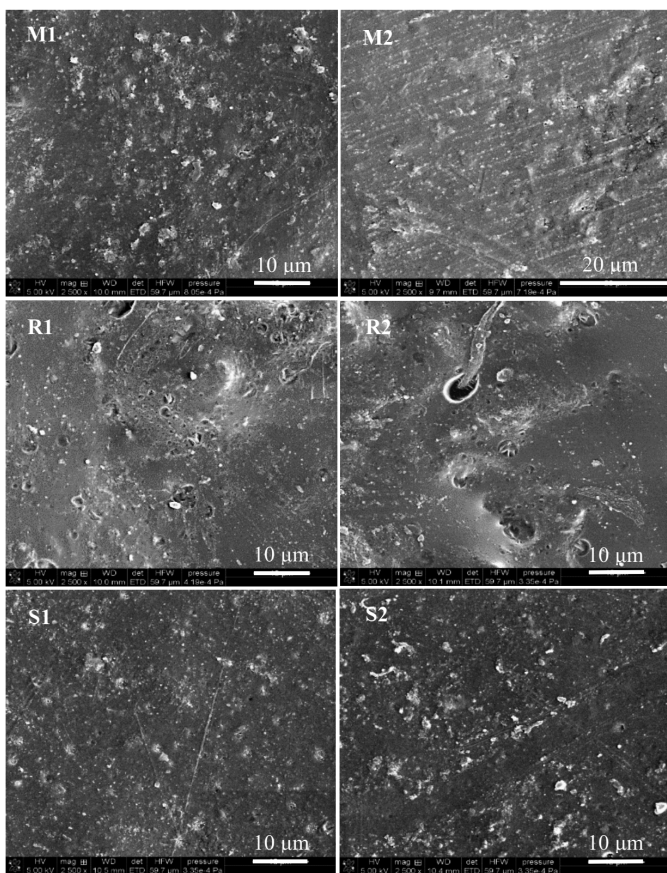
Fig. 11. Microscopic images before the cavitation erosion erosion test, SEM

The microscopic research confirmed differences in the surface structure of the tested polyester coatings. The samples R1 and R2 are significantly rougher than other tested materials. Moreover, the second layer deposition results in the occurrence of pits. These cavities may have been a result of voids formation during the deposition of the next paint layers. It conforms to our previous study [16], where the porosity in R-type coatings was confirmed. Deposition of the second layer smooths the surface of M2 and S2 which agrees with the optical profiler results and surface morphology emoluments. The uniform surface morphology affects the higher erosion resistance of S

and M-type coatings. It is known that rougher surfaces usually undergo much more severe cavitation damage. The CE mechanism of polymer coatings can be read from Fig. 12.

The SEM microscopic examination showed severe damage of R-coatings. Long, narrow cracks approximately 5 µm wide and approximately 30 µm long were observed for the M1 coating. For the R1 coating, long, narrow pits and areal material detachment of about 20 by 30 µm size were observed. In the case of the S1 coating, long, narrow cracks and losses of approximately 30 by 20 µm as well as deep pitting were observed.

Ning *et al*. [21] indicate that adhesion and coating thickness are factors that have a crucial effect on epoxy resin CE resistance. On the other hand, in the case of ultra high molecular weight polyethylene (UHMWPE) Deplanes *et al*. [20] stated that the thickness of the polymer coating does not appear to affect damage in the investigated range from 2 mm to 4 mm. Similarly, in our study, the influence of repainting on the resistance to CE has not been stated. Findings obtained in the current paper also confirmed that coatings surface finish (initial surface morphology) shows a predominant effect on the CE resistance of polyester coatings. The SEM microscopic tests showed significant differences in the resistance to cavitation wear, depending on the type of polyester surface finish used. In the case of matt and textured paints, it was also observed that the application of the second layer of paint significantly reduced weight loss due to the cavitation process. This effect was not visible on the S2, which may be attributed to the low first-layer surface roughness, and lower adhesion of the second layer to the first layer. The second-layer detachment is visible in Fig. 12.

Generally, the erosion mechanism of polyester coatings relies on the material brittle-ductile behaviour, cracks formation, lateral net-cracking growth and removal of chunk coating material and formation of craters. Presence of the second phases in polyester binder acts as the centre of erosion. The cracking and polyester-binder removal initiates in the vicinity of second phase particles, which agrees with the findings given by Chi *et al*. [22], who claimed that the fillers and glass flakes of the epoxy-based coatings play a negative role in CE resistance.

Cavitation cyclic impacts due to fluid micro-jets and pressure waves induce the fatigue and fragmentation of coating material, connecting of the cracks (net-cracking), and poorly cohered material chunks detachment. Finally, polyester coating is spalling (pit-formation) and the metallic substrate is exposed to CE. The fracture of M and S samples display brittle-ductile mode while the R-type coatings present predominantly brittle behaviour. The ductile wear and uniform surface finish slow the erosion rate; therefore, the R-type coating is not recommended for anti-cavitation applications.

Summing up, the repainting, by the electrostatic spray of the second layer of polyester material reduces R_t roughness parameter and does not reduce the coatings CE resistance. In fact, polyester coatings can be hardly recommended as a protection against CE of hydraulic machinery and equipment. Although such protection against mild cavitation may be considered their secondary task. Moreover, polyester coatings can be successfully utilised for regenerating the equipment operated in conditions of cavitation loads.

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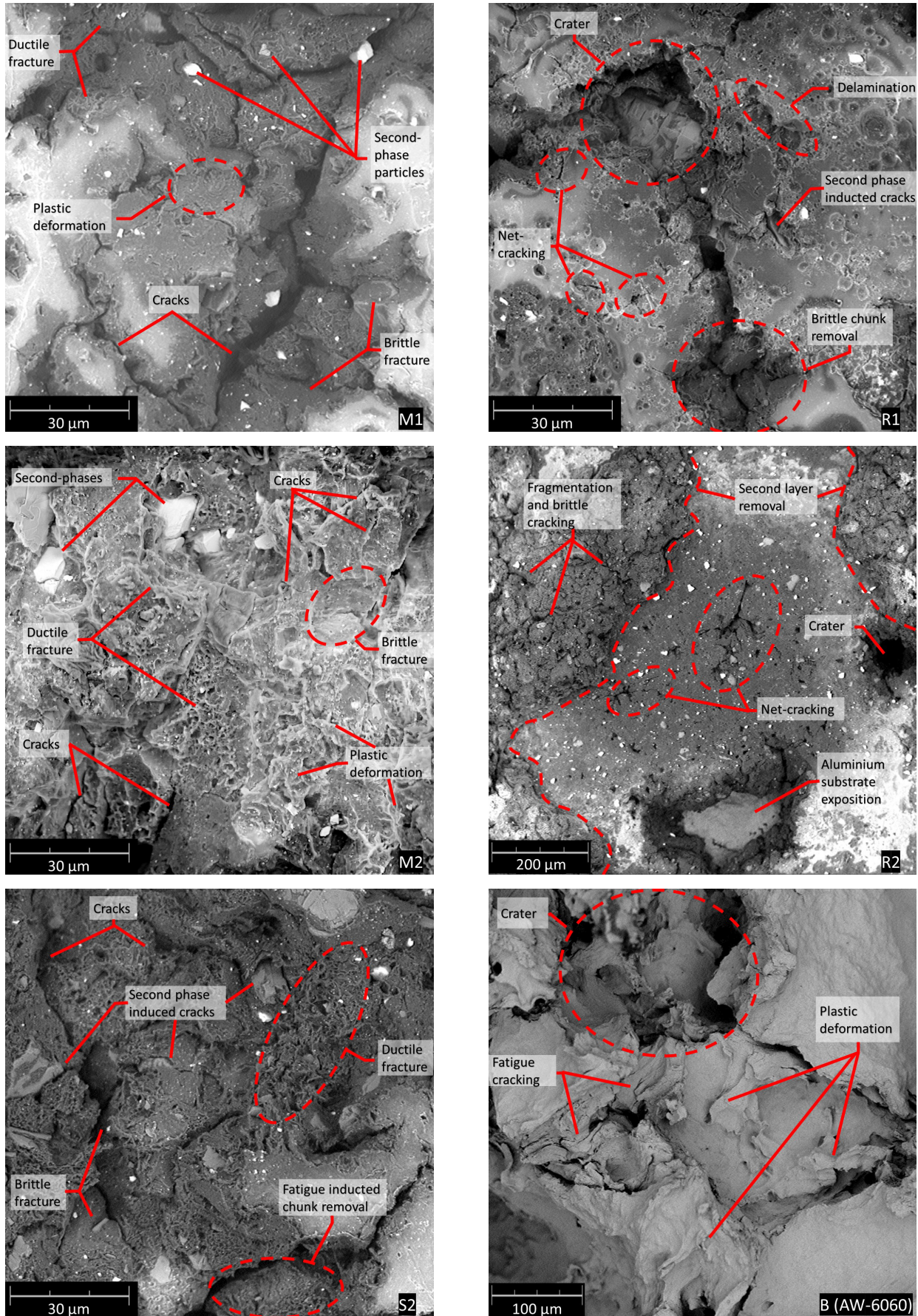
Fig. 12. Cavitation eroded surfaces of polyester coatings (M1, R1, M2, R2 and S2) and reference aluminium sample (marked as B), SEM

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4. CONCLUSIONS

This study aimed to assess the resistance to cavitation erosion (CE) of electrostatic spray polyester coatings with different surface finish. Also, the repainting effect on CE resistance was investigated. The following findings can be stated:

- Polyester coatings present higher CE resistance than the reference aluminium alloy AW-6060. The cumulative erosion rate for the most resistant to cavitation coating M2 equals of 13.2 mm³/h while aluminium sample erosion rate equals of 84.2 mm³/h.
- The highest resistance was noted for M2 (matt finish) and S1 (silk gloss finish) more than two times exceeding the CE resistance of severe cavitation damaged samples R1 and R2 (structure matt finish).
- The cavitation erosion mechanism of polyester coatings relies on the material brittle-ductile behaviour, cracks formation, lateral net-cracking growth and removal of chunk coating material and formation of craters. Predominating brittle mechanism of R-type coatings decreased their erosion resistance.
- Low roughness surface finish beneficially affects CE resistance of polyester coatings. Repainting, namely the application of the second layer of polyester coating, reduces R_t roughness parameter and does not affect the coatings resistance to CE. Therefore, it could be successfully utilised for regenerating the equipment operated in conditions of cavitation loads.

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