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production – properties – application

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SADRŽAJ/CONTENTS

stranica/page

UVODNA PREDAVANJA/KEYNOTES PAPERS

1. Thermal properties of selected dental materials

Borut Kosec, Mateja Vodlan, Blaž Karpe, Aleš Nagode, Milan Bizjak, Igor Kopač, Alenka Pavlič, Igor Budak, Tatjana Puškar, Henry Taubman, Mirko Gojić.....8

2. Nanomaterials in medicine

Vukoman Jokanović.....14

SEKCIJA METALNI MATERIJALI/SESSION METALLIC MATERIALS

1. Macroscopic method for assessing the content of non-metallic inclusions - blue fracture

Belma Fakić, Adisa Burić, Edib Horoz.....26

2. Numerical analysis of the stress condition of the vessel under pressure

Nermin Bišćević, Husmira Bišćević.....33

3. Influence of boron, zirconium and tellurium on the mechanical properties of austenitic stainless steel

Derviš Mujagić, Mustafa Hadžalić, Aida Imamović, Mirsada Oruč, Sulejman Muhamedagić.....43

4. Different aspects of material modeling by deep rolling

Ammar Sejdinoski.....49

5. Comparison of different steel types by using 3D tomography

Emina Vardo, Jessica Gola, Frank Mücklich.....59

6. Effect of uneven plastic deformation on width of clad layers of explosive welded three-layers strip

Omer Beganović, Almedina Čamdžić, Faik Uzunović.....69

7. New editions of the steel and steel casting designation standards

Mirsada Oruč, Raza Sunulahpašić, Almajda Gigović-Gekić, Sulejman Muhamedagić.....79

8. Influence of heating rate on stability of ausferrite microstructure

Hasan Avdusinovic, Almajda Gigovic-Gekic, Sehzudin Dervisic.....84

9. Ductile iron microstructure design using heat treatment processes

Hasan Avdusinovic, Salaheldin Abdelmagid Mohamed Badreldin, Mohammed Abdelgadir Abdalla Mohammed.....90

10. Heat treatment of low alloyed steels 17 CrNiMo6 and 20CrMo5 – carburization

Belma Fakić, Mohamed Fadlalla Mohamed Ahmed, Mohammed Almuntaga Ahmed Tambl Fadul.....98

11. Effect of deformation and heat treatment on microstructure of warm rolled steel in alpha-gamma area

Omer Beganović, Belma Fakić, Ali Mohammed Ali Mohammedzain, Babekir Ahmed Osman Mohammed, Faik Uzunović.....107

12. **Optimisation of chamber furnace technological parametrs for high chromium steel rolls heat treatment**
Blaž Karpe, Simon Rečnik, Aleš Nagode, Borut Kosec, Sergej Novak, Stjepan Kozuh.....117
13. **The microstructure of the scale formed during the high temperature oxidation of a fecral alloys**
Stojana Veskovič, Milan Bizjak, Blaž Karpe, Aleš Nagode, Samo Smolej, Janez Kovač, Gorazd Kosec.....125
14. **Evaluation of the microstructure and phase transition temperatures of the Cu-9%Al-8%Mn shape memory alloy**
Dragan Manasijević, Tamara Holjevac Grgurić, Ljubiša Balanović, Uroš Stamenković, Radiša Todorović, Milan Gorgievski, Mirko Gojić.....135
15. **Microstructure of metalls coatings NiCrAlY**
Milenko Rimac, Mirsada Oruč, Gorazd Kosec.....141
16. **Example of decarburising phenomena during the carburasing heat treatment process**
Jusuf Duraković, Almaida Gigović-Gekić, Belma Fakić.....147
17. **Phase equilibria of the Cu-In-Ni ternary system at 300 °C**
Aleksandar Đorđević, Milena Premović, Duško Minić, Vladan Čosović, Milutin Živković, Ljubiša Balanović, Dragan Manasijević, Milan Kolarević.....153
18. **The quality of GI25 oil pumpe cover casting made in mold of bentonite mixture of one fraction quartz sand**
Ajla Huseljić, Ana Beroš, Hasan Avdušinović.....161
19. **Recovery of manganese from steel slag and dust by different technologies**
Aida Imamović, Raza Sunulahpašić, Amna Hodžić.....170

SEKCIJA NEMETALNI MATERIJALI / SESSION NONMETALLIC MATERIALS

1. **Optical microscopy evaluation of portland cement clinker - acetic acid etching preparation**
Nevzet Merdić, Nedžad Haračić, Ilhan Bušatlić, Nadira Bušatlić, Adis Merdić.....178
2. **The influence of clinker dust on blast furnace cement properties**
Nevzet Merdić, Nedžad Haračić Ilhan Bušatlić,, Nadira Bušatlić, Zehrudin Osmanović, Nisad Avdić.....184
3. **Separability of discrete optical properties of molecular crystalline nanostructures**
Siniša M. Vučenović, Jovan P.Šetrajić.....192
4. **The influence of the phosphoric acid and clay on the physical and mechanical properties of refractory concrete**
Nadira Bušatlić, Ilhan Bušatlić, Nedžad Haračić, Nevzet Merdić.....198
5. **The influence of the added amount of gypsum on the portland cement hydration heat**
Ilhan Bušatlić, Amna Karić.....206

6. High-strength concrete (hsc) material for high-rise buildings <i>Ilda Kovačević, Sanin Džidić.....</i>	214
7. Prognosis of reactivity and strength of coke based on modified basicity index model <i>Sulejman Muhamedagić, Mirsada Oruč, Admir Muminović, Amina Kurtović.....</i>	224
8. Cavitation of refractory samples based on talc and zeolite from Zlatokop, Serbia <i>Jelena Majstorović, Sanja Martinović, Milica Vlahović, Marina Dojčinović, Marko Pavlović, Tatjana Volkov Husović.....</i>	230
9. The effects of the distribution coefficient on the properties of the refractory castables from the chamotte waste and clay “Rapajlo” <i>Marina Jovanović, Adnan Mujkanović, Nadira Bušatlić.....</i>	234
10. The effects of nanosilica on the physical-mechanical properties of concrete <i>Adnan Mujkanović, Marina Jovanović, Amel Zahirović.....</i>	242
11. Optimization of process parameters in the production of powdered explosives in PS vitezit <i>Šefkija Botonjić, Azra Halilović, Irma Ramić.....</i>	248

**SEKCIJA ZAŠTITA RADNE I ŽIVOTNE SREDINE I ODRŽIVI RAZVOJ /
SESSION ENVIRONMENT PROTECTION AND SUSTAINABLE
DEVELOPMENT**

1. Analysis of thickness of ecological material, orientated polypropylene for the packaging of dried fruit <i>Ajka Aljilji, Nebija Aljilji.....</i>	257
2. Quality control of drinking water <i>Asim Ibrahimagić, Amina Valentić.....</i>	262
3. Chemical analysis of heavy metals in leaf of green salad and assessment of contamination <i>Farzet Bikić, Fatima Baltić, Dejana Kasapović, Amira Pašalić.....</i>	270
4. The examination of the most important quality parameters of wastewater from cellulose and paper industry and its influence at surface water recipient <i>Ilhan Bušatlić, Šefkija Botonjić, Azra Halilović.....</i>	274
5. Air Quality Index (AQI) – comparative study and assessment of an appropriate model for B&H <i>Samir Lemeš.....</i>	282
6. Simulation of acoustic noise elimination of an audio profile generated by urban environments in Tirana, Albania Modeling via Matlab/Simulink <i>Jozef Bushati, Virtyt Lesha, Darko Petković, Diana Karuović.....</i>	292

CAVITATION OF REFRACTORY SAMPLES BASED ON TALC AND ZEOLITE FROM ZLATOKOP, SERBIA

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Keywords: talc, zeolite, cavitation erosion, image analysis, Young modulus of elasticity

ABSTRACT

Samples based on talc with 15 % of zeolite from Zlatokop, Serbia, sintered at 1200 °C were prepared and tested in condition of cavitation erosion. The ultrasonic vibratory cavitation set up with stationary specimen was used. Mass loss was measured and degradation level of the samples using image analysis and Young modulus of elasticity was monitored. Obtained results showed good resistance to the cavitation erosion giving the possibility of future application in different conditions where cavitation erosion is expected.

1. INTRODUCTION

Zeolite is widely used for different applications in medicine, chemical engineering, metallurgy, removal of heavy metals from nuclear, mine and industrial wastes [1, 2, 3, 4], in agricultural for soil conditioner and animal feed supplement [5]. Many authors were investigated zeolite deposits in Serbia [6, 7, 8] and their possible application.

Cavitation erosion is phenomenon which could be observed where the fluid which is transported with some velocity is in the contact with engineering material. Cavitation transport phenomena are well described in the literature, and mostly related to the metallic materials [8, 9, 10, 11]. In this paper material based on talc with 15% zeolite from Zlatokop, Serbia deposit, synthesized and sintered at 1200 °C will be investigated in cavitation erosion conditions.

2. MATERIALS

Sample was prepared as a mixture of talc and 15 % zeolite from Zlatokop deposit. Samples were pressed and sintered under the following conditions: raising the temperature to 1000 °C

with a heating rate of 5 °C/min, then heating to 1200 °C with heating rate of 2 °C/min with dwell time of 1 hour; cooling of the sample was carried out within the oven. XRD and SEM of the sample sintered at the conditions given above are given at the Figure 1.

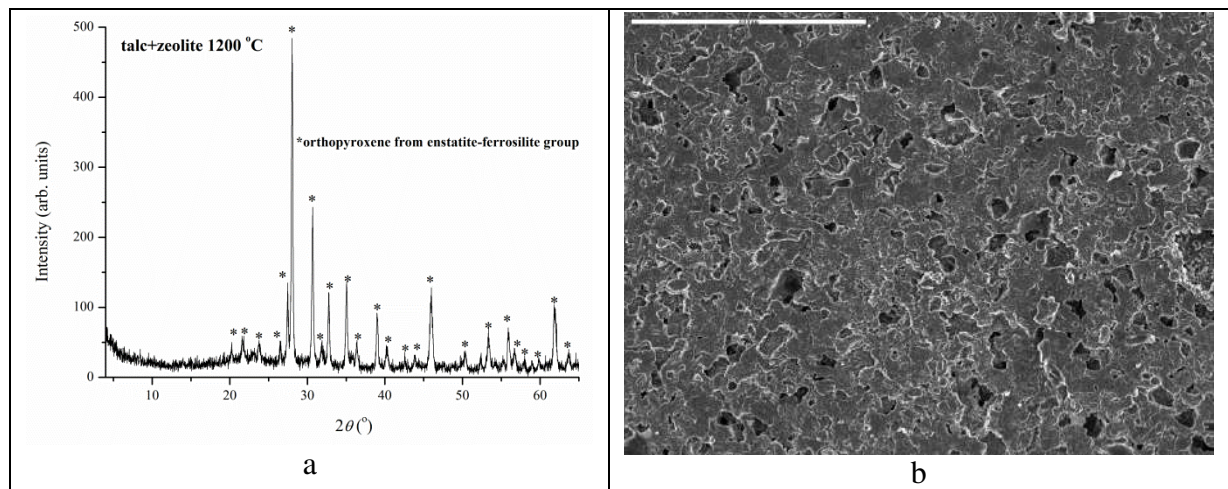


Figure 1. XRD (a) and SEM (b) of the sintered sample

3. EXPERIMENTAL PART

Cavitation resistance was investigated according to the ultrasonic vibration method (with stationary sample) applying water flow (5-10 ml/s) according to ASTM G32 standard [12]. Mass loss was used to determine the degradation of sample. Additionally, samples were photographed, and image analysis was performed for determination of the surface degradation level. Young modulus of elasticity was determined based on UPVT (ultrasonic pulse velocity method).

4. RESULTS AND DISCUSSION

Image of the sample and mass loss during the cavitation testing are given in the Figure 2. As can be seen, after 80 minutes degradation ring which corresponds to the area of the horn was observed. Mass loss results indicated that during the experiment degradation of sample was increasing almost linearly.

Additional determination of the degradation level was applied using image analysis for surface degradation and Young modulus of elasticity for volume degradation of the sample. Obtained results are given at the Figure 3. According to the results, after 80 minutes the surface degradation level reached 12.76%, while the Young modulus of elasticity decreased for 48 % from the value before experiment.

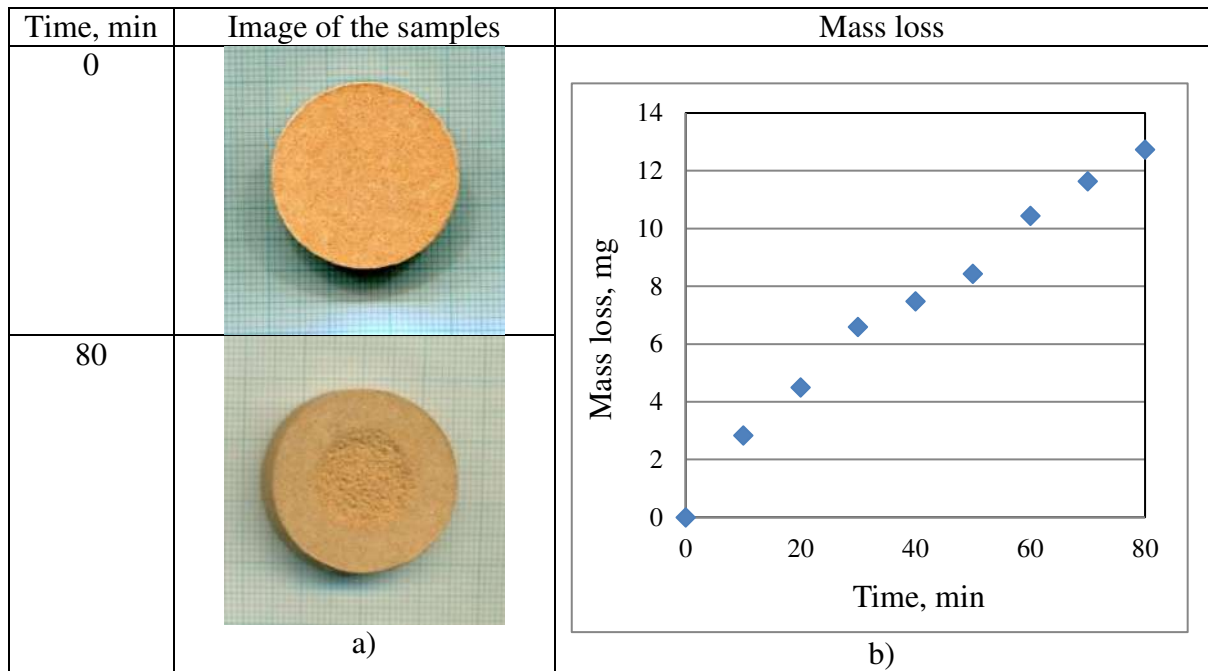


Figure 2. Image of the samples (a) and mass loss during testing (b)

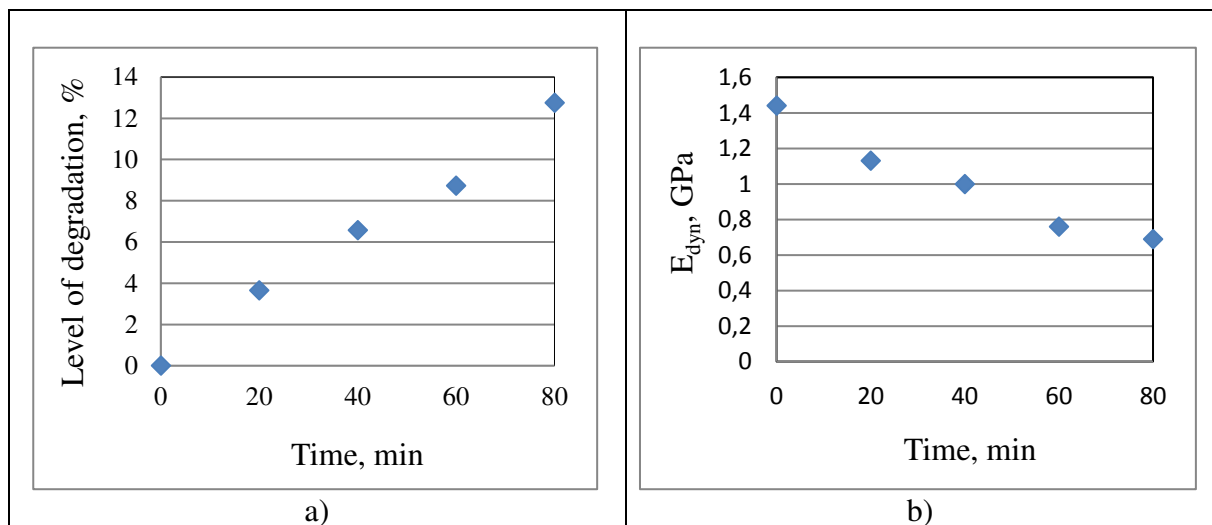


Figure 3. Level of degradation (a) and Young modulus of elasticity during the testing (b)

5. CONCLUSION

In this paper cavitation erosion of sample based on talc and zeolite was investigated. Different methods were used for monitoring behavior of the sample in these conditions:

- mass loss,
- image analysis for surface level degradation and
- Young modulus of elasticity measurements for volume degradation.

According to used approach, for overall insight it is recommended to apply those three methods.

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