



MME SEE

CONGRESS 2023

5th Metallurgical & Materials Engineering
Congress of South-East Europe
Trebinje, Bosnia and Herzegovina
7-10th June 2023

BOOK OF
ABSTRACTS

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Editors:

Dr. Miroslav Sokić,

Institute for Technology of Nuclear and Other Mineral Raw Materials

Dr. Branislav Marković

Institute for Technology of Nuclear and Other Mineral Raw Materials

prof. Dr. Vaso Manojlović

Faculty of Technology and Metallurgy, University of Belgrade

Technical editor:

M. Sc. Gvozden Jovanović

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CORROSION OF CERAMIC-METAL COMPOSITES IN ARTIFICIAL ACID RAIN

Milovan Stoiljković¹, Vladimir Pavkov¹, Gordana Bakić², Aleksa Luković¹, Vesna Maksimović¹

e-mail: vesnam@vinca.rs

1-Vinča Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade, Belgrade, Serbia,

2-Faculty of Mechanical Engineering, University of Belgrade, Belgrade

In this work, the basalt deposits site from southern Serbia was used as a matrix for the composite materials. The corrosion behavior of basalt matrix composites with various ratios of commercial stainless steel 316L (5, 10, 15, and 20 wt.%) and bulk basalt produced by sintering in the air ($t=1060^{\circ}\text{C}$ and $\tau=60$ min) were studied by immersion corrosion technique. The samples were immersed in a solution of artificial acid rain $\text{H}_2\text{SO}_4:\text{HNO}_3 = 9:1$ at $\approx \text{pH } 3$ to measure the concentration of released metal ions using inductively coupled plasma-optical emission spectrometry (ICP-OES). The elements Fe, Cr, Mn, and Ni were monitored, while the others were below the limit of quantification. The concentrations of the metal ions in the solution were studied over 15 weeks. The ions release rate from all the sintered samples was found to follow the Weibull cumulative distribution function (CDF). This means that the release rate changes over time and allows us to calculate the characteristic times of ion release. The changes in the samples were monitored by light microscopy (LM), scanning electron microscopy (SEM), X-ray diffraction (XRD), and weight loss. Sintered basalt shows high resistance to corrosion with a characteristic time of about 18 years for Fe and more than 25 years for Cr and Mn. The weight difference between the initial and after 15 weeks of exposure to the solution (sintered basalt) was not observed. On the other hand, the presence of 5 wt.% steel powder in the sintered basalt accelerates the release of metal ions by about six times. When the steel powder content in the composite materials increases, the metal release rate does not change further, but a weight loss is observed. The characteristic times for Fe, Cr, Ni, and Mn in composite materials are about 5 years. These composite materials can be investigated as materials for using in an acid environment.

Keywords: composite materials, basalt, artificial acid rain, corrosion, Weibull distribution

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