

# **International Scientific and Technical Conference: Structuring, Strength and Destruction of Composite Materials and Structures (SSDCMS 2021)**

Held online due to COVID-19

IOP Conference Series: Materials Science and Engineering  
Volume 1162

Odessa, Ukraine  
8 - 9 April 2021

## **Editors:**

**V.M. Vyrovoy  
S.O. Kroviakov**

**S.S. Makarova  
N.V. Kazmirchuk**

ISBN: 978-1-7138-3429-8  
ISSN: 1757-8981

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

This work is licensed under a Creative Commons Attribution 3.0 International Licence.  
Licence details: <http://creativecommons.org/licenses/by/3.0/>.

No changes have been made to the content of these proceedings. There may be changes to pagination and minor adjustments for aesthetics.

Printed with permission by Curran Associates, Inc. (2021)

For permission requests, please contact the Institute of Physics  
at the address below.

Institute of Physics  
Dirac House, Temple Back  
Bristol BS1 6BE UK

Phone: 44 1 17 929 7481  
Fax: 44 1 17 920 0979

[techtracking@iop.org](mailto:techtracking@iop.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

## **NANOTECHNOLOGY IN THE PRODUCTION OF BUILDING MATERIALS**

NANOMODIFICATION OF MINERAL BINDERS .....	1
<i>V Derevianko, N Kondratieva, V Volkova, H Hryshko</i>	

## **BUILDING MATERIAL PROPERTIES**

PHYSICAL AND MECHANICAL PROPERTIES OF HYBRID-REINFORCED DECORATIVE CONCRETE.....	15
<i>A D Dovgan, V M Vyrovoy, S V Sukhanova</i>	

## **WOODEN CONSTRUCTIONS**

FEATURES OF THE ORGANIC-MINERAL INTUMESCENT PAINTS STRUCTURE FORMATION FOR WOODEN CONSTRUCTIONS FIRE PROTECTION.....	22
<i>S Guzii, T Kurska, Y Otrosh, P Balduk, Y Ivanov</i>	

## **REINFORCED CONCRETE STRUCTURES**

MODELING OF THE STRESS-STRAIN STATE OF REINFORCED CONCRETE BEAMS UNDER PROLONGED LOAD ACTION .....	37
<i>Z Holovata, S Neutov, M Surianinov</i>	

## **ENERGY-EFFICIENT MATERIALS**

GENERALIZED OPTIMALITY CRITERIA OF ENERGY-EFFICIENT COMPOSITES.....	46
<i>V Kersh, A Kolesnikov, N Khlytsov, A Foshch</i>	

## **MECHANICAL PROPERTIES OF COMPOSITES**

VARIETY OF STRUCTURE AND CHANGES IN THE PROPERTIES OF BUILDING COMPOSITES OVER TIME.....	54
<i>O Korobko, N Urazmanova, I Grynyova, L Dudnik</i>	

## **CRACK FORMATION OF CONCRETE ELEMENTS**

RESEARCH OF CRACK FORMATION IN INSEPARABLE DOUBLE-SPAN REINFORCED CONCRETE ELEMENTS .....	62
<i>O Krantovska, L Ksonshkevych, M Petrov, S Synii</i>	

## **FIBER-REINFORCED CONCRETE**

STEEL FIBROUS CONCRETE WITH HIGH-EARLY STRENGTH FOR RIGID PAVEMENTS REPAIR.....	69
<i>S Kroviakov, V Kryzhanovskiy, M Zavoloka</i>	

## **BEAM ELEMENTS ON SOLID FOUNDATION**

DEVELOPMENT OF AN ANALYTICAL METHOD FOR CALCULATING BEAMS ON A VARIABLE ELASTIC WINKLER FOUNDATION .....	76
<i>Yu Krutii, M Surianinov, S Petrash, M Yezhov</i>	

## **PHYSICAL PROPERTIES OF BUILDING MATERIALS**

CHANGE IN EFFECTIVE VISCOSITY AND LEVEL OF SYNERGISM OF CEMENT-CONTAINING MECHANOACTIVATED SUSPENSION .....	87
<i>L Ksonshkevych, I Barabash, K Streltsov, O Krantovska</i>	

## **PROPERTIES OF CONSTRUCTIONAL MATERIALS**

TRIAD «STRUCTURE, INFORMATION, FRACTALITY» .....	92
<i>V Martynov</i>	

## **INFLUENCE OF SOLAR ENERGY ON THE PRODUCTION OF COMPOSITE MATERIALS**

EVALUATION OF THE EFFICIENCY OF USING SOLAR ENERGY IN THE PRODUCTION OF BUILDING COMPOSITES .....	97
<i>A Plit, M Zavoloka, O Shynkevych, V Vinnichenko</i>	

## **COMPOSITE BUILDING MATERIALS**

INFLUENCE OF MATRIX-FILLER THERMAL CONDUCTIVITY ON MICRO HEAT TRANSFER IN TWO-COMPONENT COMPOSITES.....	104
<i>A Pysarenko, I Zaginaylo</i>	

## **STRUCTURE FORMATION OF BUILDING COMPOSITES**

ANALYSIS OF THE STRUCTURE FORMATION PROCESSES OF BUILDING COMPOSITES BY GEOMETRIC METHODS .....	111
<i>S Semenova, A Kolesnikov, G Kyrylenko, T Oliynik</i>	

## **PHYSICAL AND MECHANICAL PROPERTIES OF BINDERS**

INCREASING THE WATER RESISTANCE OF THE COMPOSITE GYPSUM BINDER FOR ARBOLITO CONCRETE DUE TO HYDROFOBIZATION .....	118
<i>O S Shynkevich, D S Linnik, I V Zaginaylo, G G Bondarenko</i>	

## **PROPERTIES OF STEEL FIBER-REINFORCED CONCRETE**

FIBER TYPE INFLUENCE ON THE REINFORCED CONCRETE UNDER AXIAL TENSION .....	128
<i>M Surianinov, D Kirichenko, I Korneieva, S Neutov</i>	

**BEARING CAPACITY OF ROAD SLABS**

EXPERIMENTAL STUDIES OF ROAD SLABS ..... 134  
*M Surianinov, S Neutov, I Korneieva, D Kirichenko*

**FRACTAL-SYNERGETIC PAVEMENT**

GEOMETRY AND GRAPHICS OF THE FRACTAL EXPANSION OF A SQUARE AND ITS  
APPLICATIONS..... 141  
*D Tkach, A Sopilniak, T Yarova, S Sereda, A Kistol*

**FIBER-REINFORCED COMPOSITES**

CRACK FORMATION AND MEASUREMENT IN CONCRETE WITH CARBON FIBER-  
REINFORCED COMPOSITES UNDER BENDING TEST ..... 154  
*Yuriy Vashpanov, Jong Gun Park, Tatyana Podousova, Gwang Hee Heo, Jung Young Son*

**STRUCTURE FORMATION OF BUILDING MATERIALS**

MODELS OF CO-EVOLUTION OF STRUCTURAL ELEMENTS OF BUILDING  
COMPOSITES ..... 160  
*V Vyrovoy, V Sukhanov, A Ielkin, S Sukhanova*

**Author Index**