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Hollow Cobalt Carbide Cubes / Reduced Graphene Oxide Nanocomposite via Cyanide Coordination Polymer for Supercapacitor Applications

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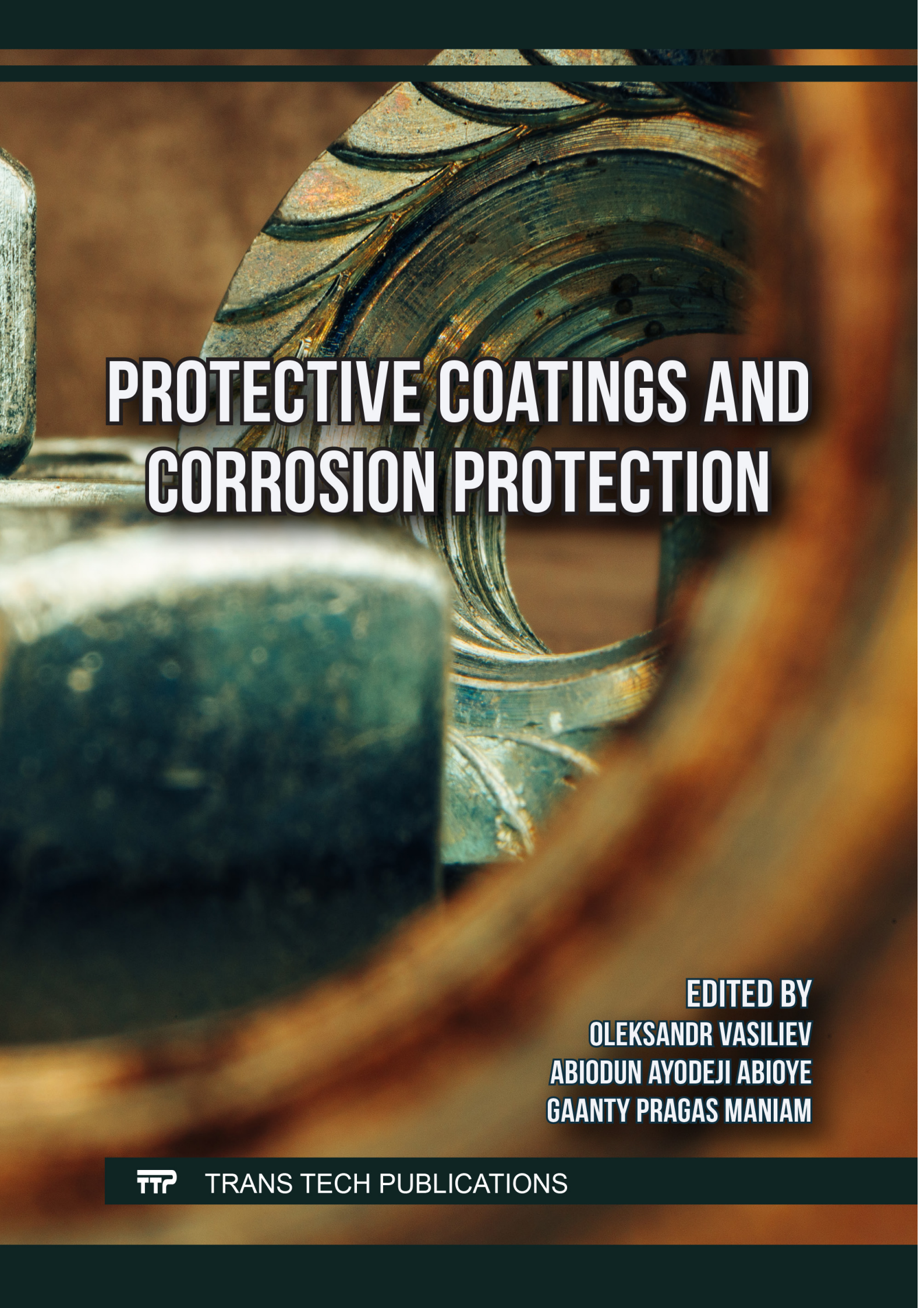

PROTECTIVE COATINGS AND CORROSION PROTECTION

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Preface

The main topics of this special issue are corrosion, corrosion protection and protective coatings of machines and equipment components.

The first chapter is dedicated to topical issues of corrosion behaviour and means of corrosion protection of structural steel and alloys. Corrosion inhibitors, anti-corrosive coatings, corrosion control, analysis of metal corrosion behaviour in various aggressive environments, etc. are presented here.

The next chapter contains articles related to tribological engineering namely an analysis of properties and deposition methods of the various wear-protective and anti-friction coatings of machine components that work in various hard conditions.

The last chapter acquaints the reader with the results of studies of the electromechanical qualities of dielectric elastomers and ehe hollow cube structure of cobalt carbide mixed with graphene synthesized using coordination polymer for high-performance supercapacitor applications.

The special edition will be useful to many engineers in mechanical engineering.

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Hollow Cobalt Carbide Cubes / Reduced Graphene Oxide Nanocomposite via Cyanide Coordination Polymer for Supercapacitor Applications

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Keywords: Cobalt Carbide, Graphene, Supercapacitor, hybrid materials.

Abstract. Coordination polymers, a broad class of porous hybrid materials resulting from the connection of metal ions with organic ligands, showcase enduring porosity, well-organised crystalline structures, and open metal active sites that augment their metal ions' redox activity. This investigation focuses on examining a nanocomposite composed of cobalt carbide/reduced graphene oxide (Co_3C/rGO) prepared through the copolymer method, serving as an electrode material for supercapacitor devices. The nanocomposite's structure and hollow cubic morphology were confirmed through X-ray diffraction, Raman spectroscopy, and field emission scanning electron microscopy (FESEM) analysis. Electrochemical properties were thoroughly assessed using cyclic voltammetry, electrochemical impedance spectroscopy, and galvanostatic charge/discharge in 6M KOH with a voltage window of 0 V to 0.5 V. The Co_3C/rGO electrode exhibited notable electrochemical performance, displaying a specific capacitance of 486.6 F g^{-1} at 1 mV s^{-1} and a low internal resistance of 0.58 Ω, surpassing existing literature due to its porous morphology. Additionally, to evaluate the nanocomposite's cycling stability, 5000 charge/discharge cycles were conducted, revealing a capacitive retention of 82% of its original capacitance after 5000 cycles. This underscores its excellent long-term durability as a high-performance material for supercapacitor applications.

Introduction

The world needs energy due to the exponential growth of the human population, which consumes the available energy sources. For centuries, non-renewable energy sources, such as fossil fuels, have been used despite their numerous negative environmental impacts, such as air pollution and global warming, due to the growth of greenhouse gas emissions. This issue motivated the search for alternate supplies, such as wind and solar energy. These energies appear to be time- or weather-dependent, so we cannot receive them consistently. To address this issue, energy storage is being investigated as a means of storing renewable energy and ensuring a reliable electricity supply.

Studying energy storage techniques, involving batteries, fuel cells and supercapacitors, has gained tremendous scholarly interest. In an enhanced iteration of capacitors, researchers have engineered

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