EMERGING MATERIALS AND TECHNOLOGIES

Metal-Organic Frameworks for Anticorrosive Coatings

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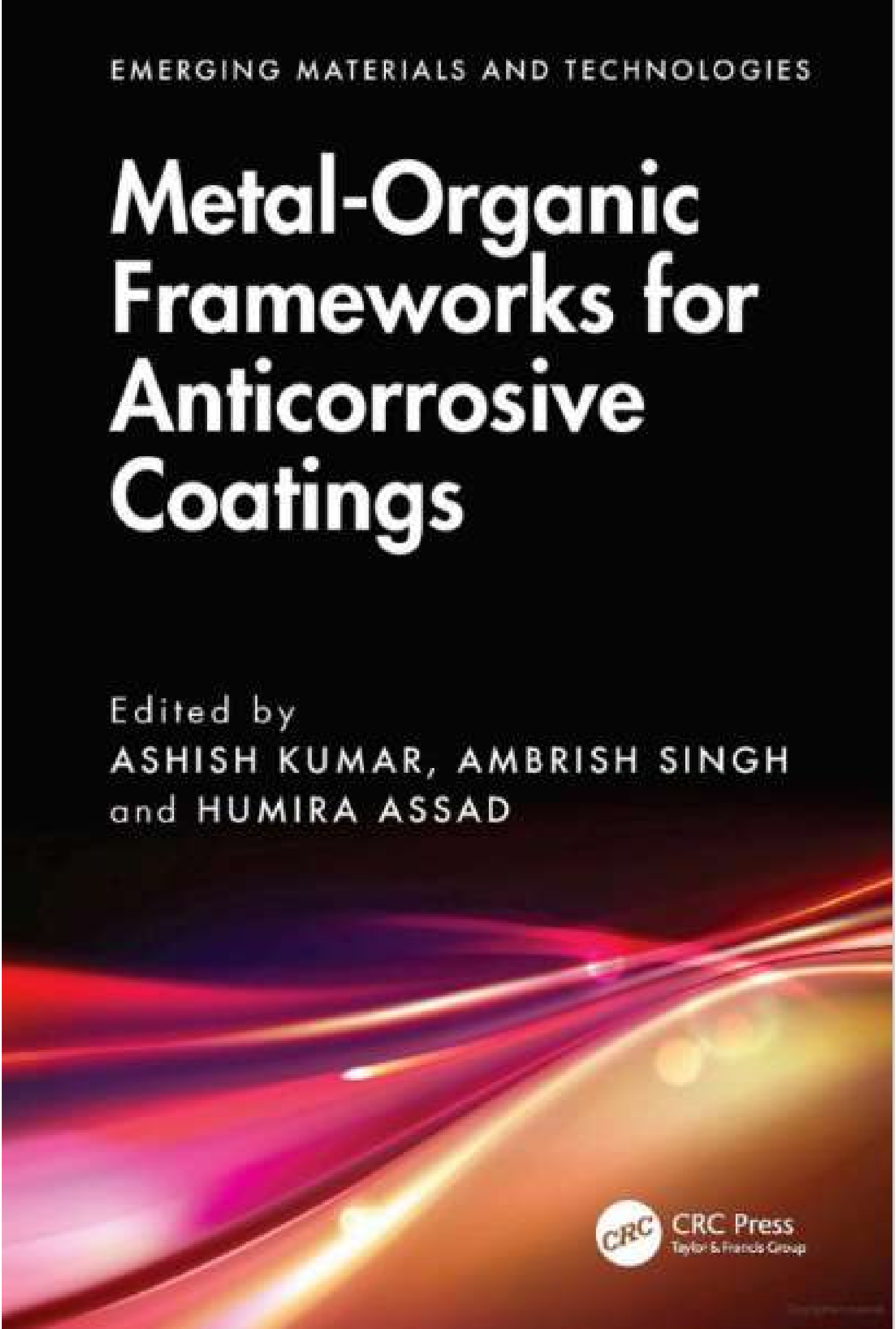

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Farhat A Ansari and Humira Assad

16.1 INTRODUCTION

Corrosion continues to be a significant and costly issue across a wide range of industries, affecting the longevity, safety, and performance of metal structures and components [1, 2]. Despite the widespread use of conventional corrosion protection methods such as coatings, galvanization, and corrosion inhibitors, these solutions often face limitations in terms of durability, environmental impact, and adaptability to extreme conditions [3, 4]. As industries demand more effective, sustainable, and long-lasting corrosion protection strategies, new materials and technologies are being explored to meet these evolving needs.

Metal–organic frameworks (MOFs) represent a promising class of materials that could address these challenges [5]. MOFs are a class of highly porous materials composed of metal ions or clusters coordinated to organic ligands, and they offer a range of unique properties such as high surface area, tunable porosity, and the ability to integrate with other materials [6]. These features make MOFs particularly suitable for improving corrosion resistance. MOFs can provide both passive protection by forming a protective barrier and active protection by releasing corrosion-inhibiting agents, thus enhancing the performance of traditional coatings [7].

This chapter will conclude all the concepts and directions discussed throughout the entire book. This chapter focuses on the conclusion and future directions of MOF-based corrosion control, examining the current state of research and the potential for MOFs to revolutionize anticorrosive coating technologies. It will explore the progress made in understanding MOFs' mechanisms for corrosion protection, the types of MOFs that show promise for industrial applications, and the challenges faced in scaling up these technologies for widespread use. Additionally, the chapter will address the remaining gaps in knowledge and the opportunities for further research that could drive the development of more efficient, durable, and sustainable MOF-based anticorrosive solutions. In doing so, it aims to provide a comprehensive overview of the future trajectory of MOF-based corrosion control and its potential to transform the way we approach corrosion protection in the years to come.

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