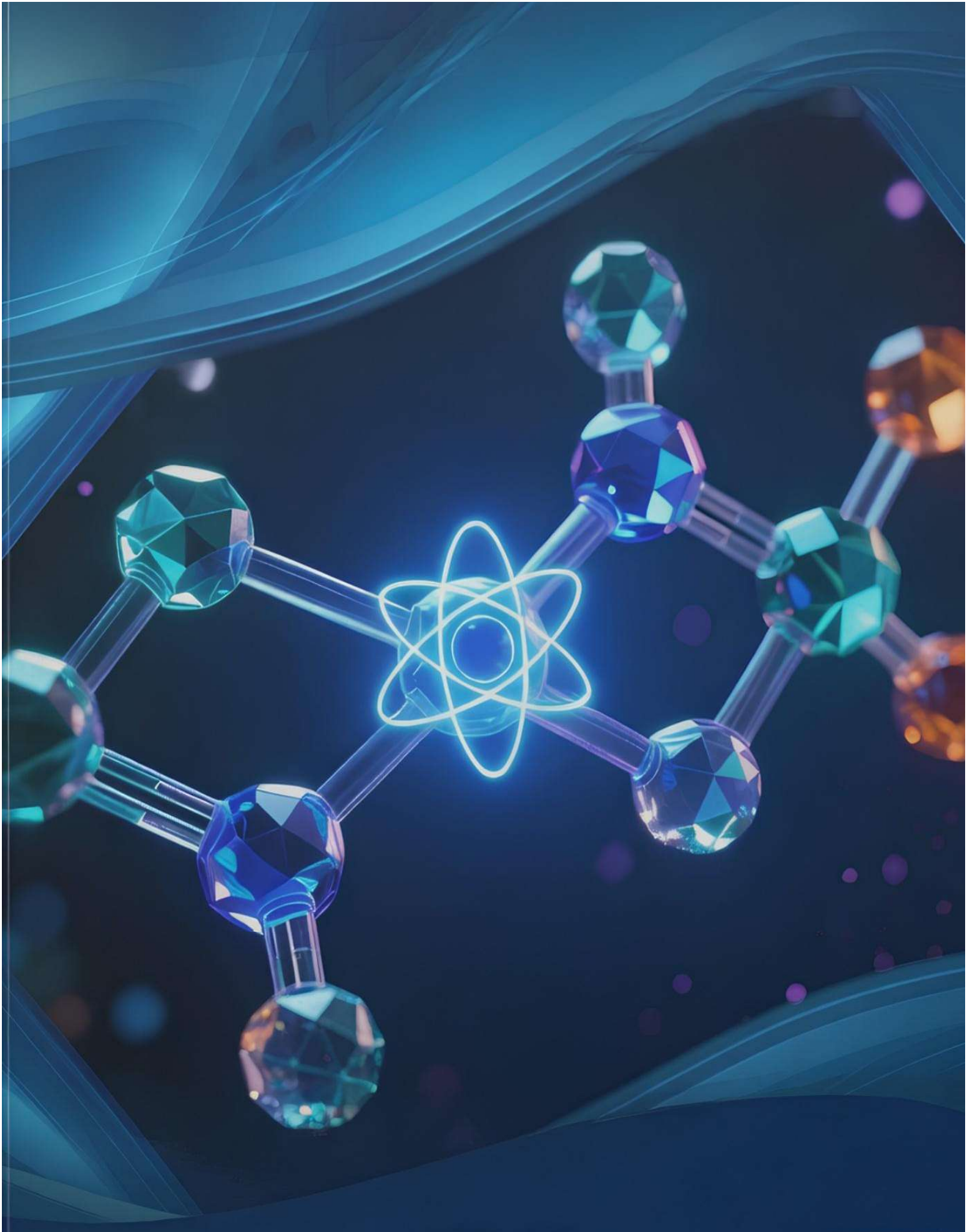

AMT 2026

ADVANCED MATERIALS AND TECHNOLOGIES
JUNE 14TH - 17TH, ŁÓDŹ, POLAND

Effect of Initial Microstructure on High Temperature Oxidation of MAR-M247 Nickel Based Superalloy

Karolina Piotrowska[1,*], Kamil Bochenek[1], Mateusz Kopec[1]

[1]*Institute of Fundamental Technological Research Polish Academy of Sciences, Poland*

[*]*kpiotrow@ippt.pan.pl*

Abstract

The effect of initial microstructure on the high-temperature oxidation behaviour of the nickel-based superalloy MAR-M247 was investigated. Three distinct microstructural conditions—fine-grained, coarse-grained, and columnar—were produced and exposed to air at 900 °C for durations up to 500 h. Oxidation kinetics, scale morphology, and subsurface degradation were evaluated to assess the role of grain size and grain orientation on oxidation resistance. The results demonstrate that the initial microstructure significantly influences oxide scale development, adherence, and internal oxidation behaviour. Differences in grain boundary density and diffusion pathways led to distinct oxidation mechanisms among the microstructures, with implications for long-term performance of MAR-M247 in high-temperature applications.

Keywords: high-temperature oxidation, nickel-based superalloys, microstructure, oxide scale formation