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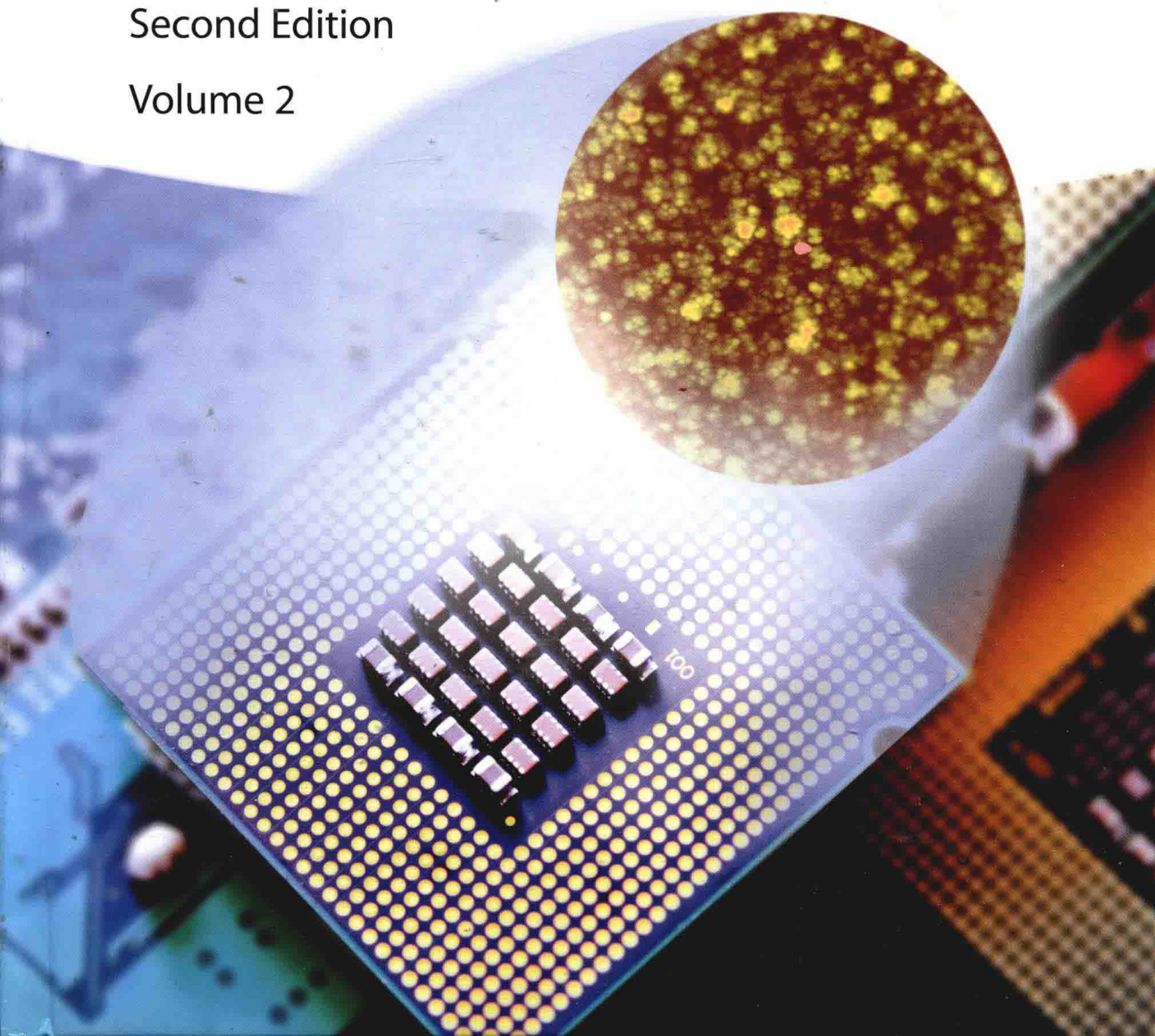
, Matthias Werner, and Hans-Jörg Fecht

The Nano-Micro Interface

Bridging the Micro and Nano Worlds

Second Edition

Volume 2



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Marcel Van de Voorde, Matthias Werner, and Hans-Jörg Fecht

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Foreword

Curiosity-driven fundamental research is part of human culture, the benefit of which is improved knowledge and understanding of phenomena, behavior, processes, and organic and inorganic matter. An integral part of curiosity is raising the question on intelligent and sustainable use of the knowledge, for example, for improving the quality of life. Society not only tolerates but also favors and finances research work; not forever, as at a certain point, the proof of usefulness of new results and dedicated innovation becomes evident. Fantasy and imagination have to be followed by innovation with market potential, economic benefit, and creation of working places.

The fascination of nanoscience has been based on curiosity. An unexploited body of phenomena, matter, and behavior offered almost unlimited development for fantasy and imagination. For most fields of human needs like housing, daily water and food, health, communication, mobility, and power providing comfort for life nanoscience principally offers great potential for advanced solutions.

The potential is based on some of the main characteristics of nanoscience and nanotechnology: small mass and volume (a small number of atoms and molecules) per material unit with a high ratio of atoms/molecules of different behavior at surfaces, a very large number of material units to be built together with new architecture (“architectonics”^{*}), potentially interface-dominated stringent space limitations for electric charges, and consequences on electric, magnetic, and optic behavior of building blocks. The great potential for innovation offered by nanoscience and nanotechnology is evident. As a matter of fact, for the last decades, nanoscience and nanotechnology has been a university and research center topic to a large extent. Nano-Industry is still in its infancy: nano-Electronics and nano-Chemistry are already on the way of industrialization, nano-Health and nano-Biotech made a good start, and nano-Structural materials have still to find their way and need to be promoted.

Nano-Industrialization needs development of fabrication and manufacturing. *Top-down* approaches based on continuous tailoring and miniaturization from the microscale as well as *bottom-up* approaches based on assembling nanoscale units or new collective phenomena based on nanoscale effects need to be developed for the production of new sustainable and safe devices in industrial quantities.

This book is an important and early contribution to the development of nano-Manufacturing. It provides some directions for nano-Industry developments in the near future, especially for nano-Electronics and nano-IT, nano-Power and nano-Health, it describes examples with successful industrialization, and shows visions for the future in Europe, United States, and Asia.

Tsukuba

April 2014

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