Volume Preface

Nanotechnology is a strategic driver of innovation, which has been identified as a key enabling technology (KET) in Horizon 2020 to support industrial leadership in Europe. It involves the development and use of materials and objects at the nanoscale (1–100 nm). When intentionally manufactured, nanomaterials are frequently referred to as engineered nanomaterials (ENMs). However, nanoparticles (NPs) may also be unintentionally generated during industrial processes which do not involve nanomaterials as input or output products.

Due to the increasingly widespread use of nanomaterials, it is critical to identify any potential risks they may pose to human health or the environment. Nanosafety is concerned with the safe and sustainable development of nanotechnology, and it is a necessary tool to ensure the widespread application of nanotechnology without which the potential risks could overcome the expected benefits of nanotechnology applications. The need for effective risk governance, which is crucial when developing new technologies such as nanotechnologies, has been evidenced [1]. Furthermore, comprehensive roadmaps such as *Nanosafety in Europe 2015–2025* [2] provide a strategic vision for future research on the safe use and application of ENMs. Initiatives such as the Nanosafety Cluster initiative (http://www.nanosafetycluster.eu/) are succeeding in maximising the synergies between existing research projects addressing all aspects of nanosafety including toxicology, ecotoxicology, exposure assessment, mechanisms of interaction, risk assessment and standardisation.

In this framework, this volume aims to provide an overview of the determinants of release and exposure scenarios of airborne NPs, whether intentionally or unintentionally generated. The dosimetry and toxicology of nanosized particles and fibres are reviewed in the chapter "Dosimetry and Toxicology of Nano-Sized Particles & Fibres", highlighting their potential threat for human health and safety and discussing the main drivers of adverse health outcomes. The chapters "Measurement Methods for Nanoparticles in Indoor and Outdoor Air" and "Exposure Assessment: Methods" are devoted to NP measurement and exposure assessment methods and provide a comprehensive overview of the tools and strategies available to characterise exposures in indoor and outdoor settings. Special attention is given to knowledge gaps and to limitations with regard to current instrumentation and standardisation needs. NP sources, release mechanisms and determinants, including case studies, are discussed in the chapters "Occupational Release of Engineered Nanoparticles: A Review", "Nanoparticle Release in Indoor Workplaces: Emission Sources, Release Determinants, and Release Categories Based on Workplace Measurements", "Nanoparticles Release from Nano-Enabled Products" and "Workplace Exposure to Process-Generated Ultrafine and Nanoparticles in Ceramic Processes Using Laser Technology". These chapters review available studies which report on the release of airborne ENMs in different nanotechnology workplaces, covering topics of relevance to occupational exposure ranging from the identification of release mechanisms and scenarios to measurement methods and working towards a standardised approach to exposure characterisation. Use-phase release scenarios are also included, as well as protocols for product ageing and nanomaterial quantification and characterisation. Exposure assessments carried out in specific case studies involving ENMs (e.g. handling of bulk material at low energy, dispersion of highly concentrated NPs) and unintentionally generated NPs (e.g. during laser sintering of ceramic tiles) are described. Because experimental exposure studies must be complemented by modelling approaches, the chapter "Quantitative Modelling of Occupational Exposure to Airborne Nanoparticles" explores tools for quantitative modelling of occupational exposure to airborne nanoparticles, taking into account mechanisms determining the likelihood of release and transport of NPs in the workplace. Finally, the chapter "The Flows of Engineered Nanomaterials from Production, Use and Disposal to the Environment" evaluates what information is needed to quantify the flows of ENMs to the environment by reviewing the current state of knowledge, taking a life-cycle approach.

Nanotechnology is a rapidly evolving field, and as a result nanosafety research must also be in constant evolution. Because of its broad scope including NP measurements, modelling, toxicology, risk assessments and standardisation, among others, one single volume cannot aim to cover all the relevant aspects in this field. Examples of issues not addressed in this volume are emerging NP forms and applications, the need for enhanced instrumentation for online detection of ENMs in the workplace, or the need for a regulatory framework and standardisation guidelines, among others. Addressing these and other knowledge gaps will help to quantify the risks associated with nanomaterials and thus promote the safe, sustainable and responsible use of nanotechnology.

This book is intended for a broad audience, from specialists working already in the field to newcomers who want to gain insights into this topic. I would like to sincerely thank all the authors for their time and efforts in preparing their outstanding contributions to this volume, as well as my coworkers for creating a motivating work environment.

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