Preface

Why a Process Engineering Approach to the Earth System?

Engineers involved in the handling, processing, and utilizing of materials and energy are constantly faced with the environmental and economic effects of their activities. These include environmental changes on local, regional and global scales, as well as the depletion of resources and the search for new raw materials and energy sources. This has been the experience of the authors during their professional activities as chemical engineers in industrial research and development, and in academic research and teaching in various areas of fuel chemistry and reaction engineering.

This book is based on a course that has been held for engineering students for more than 10 years. In writing this book, the authors were motivated by the following questions:

a) What are the factors determining macroscopic material and energy flows in the Earth's biogeosphere? What is the appropriate approach to understand potential perturbations of natural cycles, caused by human activities and to assess significant anthropogenic terms?
b) When using materials and energy, are human societies today and for the foreseeable future limited by the depletion of resources or more so by global environmental changes? As an example, discovery of large usable gas hydrate resources as a fossil energy source, would it be fortunate or more like a curse?
c) Given the considerable technology innovation and research activities ongoing worldwide: how to deal with the obvious lack of synthesis and integration approach?
d) As for the industrialized countries, to what extent can they serve as examples for less-developed countries? What are appropriate technology options for sustainable development?

Our book is intended to give a basic understanding and orientation and to stimulate discussion of these questions. It addresses students in (chemical and biotechnological) process engineering but also in other fields, and anyone interested, with

a basic knowledge in natural sciences. It is supposed to stimulate discussions about science, technology and policy aspects of global development. The authors think that *development* gives a better match with the engineering way of thinking than *global change*, as it reflects *solving problems* in addition to *analyzing problems*.

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