

FOREWORD

This book presents the courses and seminars delivered during the 1st Latin American Summer School on Materials Instabilities, organized from November 30 to December 4, 1998, at the Universidad Católica de Valparaíso, Valparaíso, Chile.

Several reasons led us to organize such a school in Valparaíso. First, of course, there are scientific ones. It is trivial, nowadays, to say that materials science is an exploding field of tremendous technological and social impact. It is effectively one of the priority area of the Fifth Framework Programme of the European Union, which has been recently launched, and also of several funding agencies of the United States of America. But, for us it is also associated with a true scientific revolution since materials design, processing and behavior, deals more, today, with nonequilibrium phenomena, irreversible thermodynamics, dynamics and instabilities and bifurcations, than traditional equilibrium concepts.

In particular, many aspects of the processing of novel materials, of their resistance or utilization in aggressive environments are related to instabilities and nonlinear dynamics. It is impossible to mention here all the examples that come to mind, but a few of them are:

- Processing of quasicrystals, high temperature superconductors, heterostructures and superlattices,
- On-demand tailoring of thin films or surfaces with specific properties through new technologies such as sputtering, plasma spray, LVD, CVD, molecular beam epitaxy, impurity doping, etc.
- Formation of regular defect microstructures under mechanical stresses (fatigue) or irradiation.
- Instabilities associated with fracture, corrosion, catalysis, laser etching, laser writing, etc.

Although most of these developments are the consequence of intense experimental activity, there is an increasing demand for a more fundamental understanding of novel materials and their properties. Hence, we think that the methods and concepts recently developed to study nonlinear phenomena, instabilities and pattern formation in complex physico-chemical systems can greatly contribute to achieve this goal, as it has been the case in domains such as hydrodynamics, chemistry and nonlinear optics, to cite the most popular ones

The aim of this school was thus to introduce these methods to scientists interested in their application to materials science and to bridge the gap between basic science and technology in this particularly important field. Similar schools have already been successfully organized in Europe and the US, and several of the lecturers participated in these activities. Nevertheless, we thought that it would be interesting to have such a type of summer school in Latin America. In fact, this idea arose a few years ago, during a meeting with the late Walter Zeller, professor at UCV, and Etienne Guyon, director of the French Ecole Normale Suprieure. Furthermore, this idea is supported by obvious geographical reasons, and also by the fact that specific and original problems may arise in this part of the world. Let us just think of the particularities of Copper metallurgy and processing in Chile, or the unexpected intensity of corrosion in tropical forests.

Furthermore, it may also complement the still growing activities on instabilities and nonequilibrium phenomena pioneered in Chile by Enrique Tirapegui.

Last but not least, Valparaiso, with the ocean, the hills, the earthquakes and many activities related to naval and Copper industry is probably a right place to study instabilities and patterns in metals and continuous media in general.

By essence, this meeting is pluridisciplinary. It deals, not only, with materials science, but also with physics, chemistry, mechanics, engineering science, applied mathematics, etc. We all know how difficult it is, nowadays, to obtain funding for such activities. We are thus particularly grateful to the persons and organizations who provided financial support, namely

- Comisión Nacional de Investigación Científica y Tecnológica de Chile (CONICYT)
- Centro Latinoamericano de Física (CLAF)
- Delegation Regionale Cone Sud de l'Ambassade de France au Chili
- Centro de Física No Lineal y Sistemas Complejos de Santiago
- Proyecto de Materiales, Consejo Interamericano para el Desarrollo Integral, Organización de los Estados Americanos

We also kindly acknowledge the hospitality of the Instituto de Física, Universidad Católica de Valparaíso, for the support of the School and the use of its facilities.

We hope that these proceedings will reflect the constructive spirit of this school. We are confident that this will be the starting point of a more continuous activity in this field in Latin America.

J.Martinez-Mardones
D.Walgraef
C.Wörner

October 1999