

PREFACE TO THE FESTSCHRIFT

The papers in this special *Festschrift* volume of *Progress in Materials Science* celebrate the materials research contributions and fields of study pursued, and in some cases, initiated by Professor Brian Cantor. The genesis of this collection of papers was a meeting held at St Anne's College, Oxford, in March 2019 for Brian, which brought together many former and current research colleagues and collaborators. The meeting heard the latest developments in research, and many presenters also reflected on the often formative and pivotal experiences they had working in Brian's research group and in collaboration. There was an extraordinary buzz and vibrancy in the discussion of the papers presented, which the attendees wanted to capture. Thus, the presenters, including some who were unable to attend at the last minute, were invited to submit a review paper based on their presentation – with a uniformly positive response. We are enormously grateful to *Progress Materials Science* and to Elsevier for agreeing to collect these contributions together into this *Festschrift* volume, and allowing one of us to act as guest editor. It is fitting that these papers should appear here, in the journal for which Brian has been an editor for more than 30 years. The guest editor is also grateful to Brian for helping him get to grips with the mechanics of the editorial system, and for his help with parts of the editorial process and review.

Brian started his research career as a PhD student at Cambridge University studying the solidification of eutectics, including detailed studies of their crystallography and deformation behaviour, and uncovering eutectic dendrites. He was then Research Assistant and Lecturer at Sussex University, UK, researching phase transformations, especially solidification, and the formation of amorphous materials. Amongst significant contributions to the theory of amorphous solids, Brian also became intrigued by the nature of crystalline, multi-component alloys, which he would later return to with great impact. Brian spent time as a visiting scientist at Banaras Hindu University, India, and then at the General Electric Research Laboratories, Schenectady, US, in both cases establishing long term

collaborations and friendships. The GE visit also accelerated a growing interest in the processing, structure and properties of complex alloys and the industrial applications of materials; it also led to the development of a Voronoi polyhedral method for analysing metallurgical structures.

Brian was appointed by Professor Sir Peter Hirsch FRS to a Lecturership in the Department of Metallurgy (now Materials), University of Oxford, in 1981, going on to become a Reader and then the Cookson Professor of Materials. He became Head of Department in 1995, overseeing a dramatic expansion in the department's breadth of research, academic staff numbers and facilities. As well continuing his fundamental studies of nucleation, solidification and phase transformations, Brian explored the development of improved metallurgical alloys, establishing near-industrial scale facilities for the processing of metal matrix composites, advanced coatings and complex alloys, in close collaboration with partners such as Alcan and Rolls-Royce. Like many of the contributors to this volume, the guest editor worked in Brian's research group during this period of growth and diversification at Oxford; many of us who have gone on to lead our own research groups have sought to recreate (often in vain!) the tremendous dynamism and energy that Brian brought to his group during that highly productive period. In the late 1990's and early 2000's Brian was able to pursue further at Oxford his earlier ideas, first formed at Sussex, concerning multi-component alloys, which led to the seminal publication with co-workers in 2004 entitled *Microstructural development in equiatomic multicomponent alloys* (*Mat. Sci. Eng.* **375-377**, 213). This work along with another published independently and almost simultaneously by Professor Yeh and colleagues in Taiwan established the field now generally known as high entropy alloys. These alloys – and the ideas underpinning them – have caught the imagination of materials scientists around the world, opening up largely unexplored regions of alloys composition space, with the enticing prospect of novel properties and applications.

In 2000, Brian became Head of the Division of Mathematical and Physical Sciences, University of Oxford, and then Vice-Chancellor, University of York (2002), and Vice-Chancellor, University of Bradford (2013), all of which he led with his customary energy and distinction. Research inevitably took more of back seat during this period, although he continued to serve as a senior scientific advisor and consultant to companies and organisations around the world.

Throughout, Brian continued his role as Editor at *Progress in Materials Science*, helping to advance the profile and impact of the journal. For more than three decades, he has been associated with the journal, starting as Associate Editor in 1988 and being appointed Editor in 1996. Since then, materials science has tremendously gained in breadth and visibility among the sciences: about 10 % of all published science papers now deal with an aspect of materials. This extraordinary development of the field is also reflected in a transition of the journal: during Brian's tenure, *Progress in Materials Science* successfully extended its scope from originally mostly metals and ceramics to include structural and functional polymers, nanocomposites, biological and biomedical materials as well as energy and sustainability issues and, increasingly, materials systems and devices. With his wide scientific horizon and energetic leadership, Brian was an important driving force behind this transition process. His editorial colleagues are very grateful for his commitment to the extraordinary success of the journal over all these years. It is noted that the annual impact of *Progress in Materials Science*, in terms of citations, has increased a hundred-fold between 1988 and 2020! The journal has arguably become the leading review journal and one of the most widely read and cited publications in the field.

In 2019, Brian became an Emeritus Professor back in the Department of Materials at Oxford and a Professor of Materials at Brunel University. He is now expanding his research activities once again, especially in multicomponent alloys and new processes to advance the sustainable use and recirculation of materials. In 2020, Brian published *Equations of Materials* (OUP), a primer text that

describes how some of the most important equations governing the principles of materials science are often relatively simple but rich in insight; it also offers the human interest stories behind some of the field's most famous scientists – a novel and compelling mixture written in a wonderfully accessible style that will help to recruit future generations of materials scientists. A further book on multicomponent alloys, and probably others, are in progress.

The papers in this volume reflect most of Brian's research interests and his key contributions, which can be broadly grouped in those concerned with nucleation and growth (Park, Guo, Fan, and their co-authors), multicomponent alloys (Chang, Sha, D.H. Kim, H.S. Kim, Grant, and their co-authors), solidification and phase transformations (Jolly and Katgerman, Chattopadhyay, Tsiakiropoulos, Llorca, and their co-authors), metastable alloys (Audebert and Galano, Zhang), and others covering design (Durodola), composites (Bunsell and Thionnet), and coatings (Poza, K.B. Kim, and their co-authors).

We hope the reader will enjoy this collection of papers and that it manages to capture at least some of the influence of Brian's distinguished and varied career thus far. On behalf of those contributors who have worked with Brian, we hope this collection will go some way to conveying our thanks for the friendship, knowledge, encouragement and wise guidance we have received from Brian; we very much look forward to keeping up with whatever comes next.

Patrick Grant, Oxford, Guest Editor,
and Eduard Arzt, Saarbrücken, Editor-in-Chief

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