

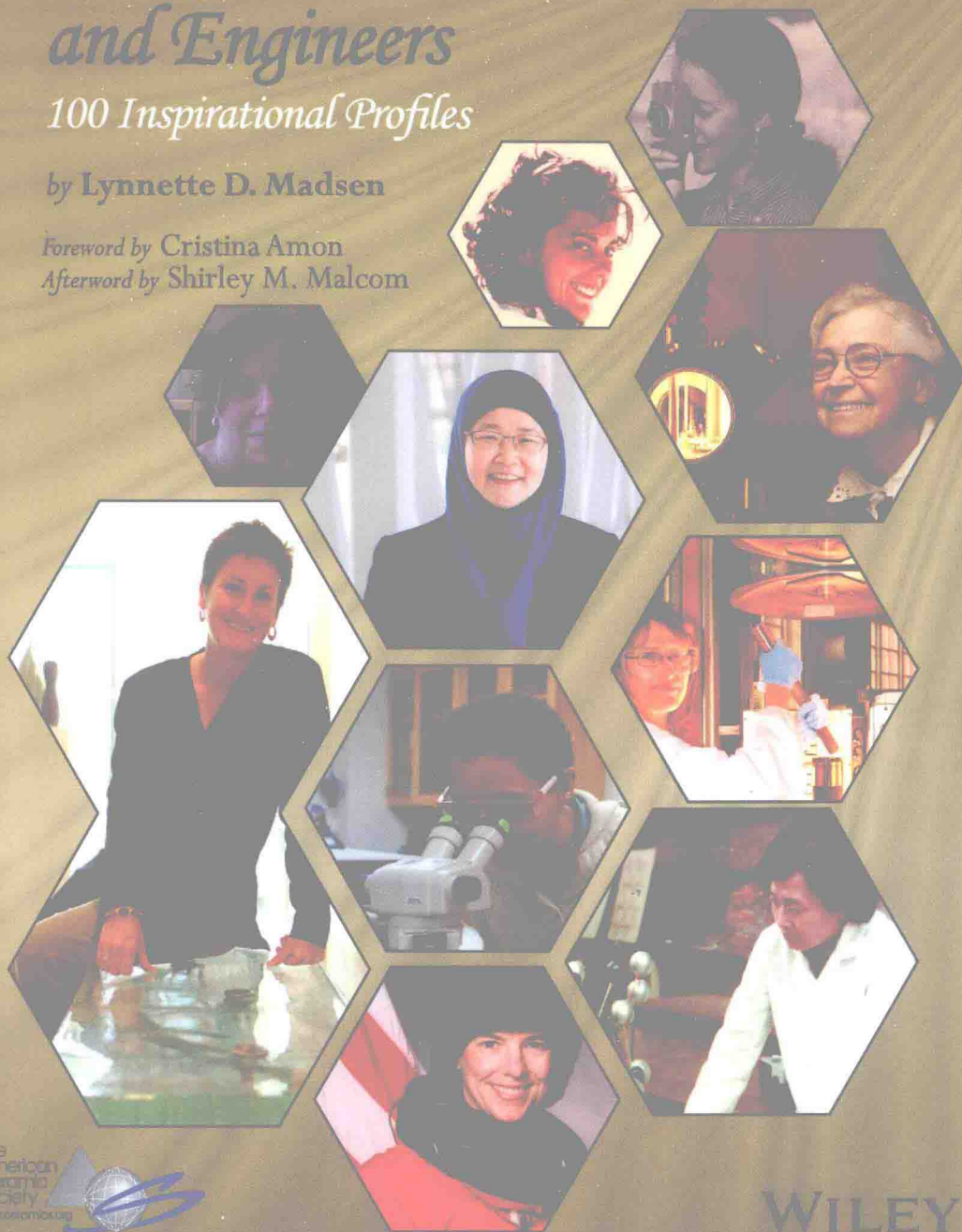
Successful Women Ceramic and Glass Scientists and Engineers

100 Inspirational Profiles

by Lynnette D. Madsen

Foreword by Cristina Amon

Afterword by Shirley M. Malcom



SUCCESSFUL WOMEN CERAMIC AND GLASS SCIENTISTS AND ENGINEERS

100 Inspirational Profiles

Lynnette D. Madsen, Ph.D.

The
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SUCCESSFUL WOMEN
CERAMIC AND
GLASS SCIENTISTS
AND ENGINEERS



*This book is dedicated to all of the women featured in it—
without their enthusiasm and perseverance in science and
engineering, successes, and willingness to share their stories,
this book would not have been possible.*

FOREWORD

It takes thousands of years for wind and water to erode a boulder before it becomes sand. Yet it takes only one person, in a single moment, to heat that sand to a temperature that changes its state from solid to liquid, then to glass. The transformation occurs at a moment when slow and natural progress meets intention.

For centuries, leaders in engineering and science have chipped away at the gendered stereotypes that exist in our fields. These champions have encouraged girls and young women to pursue their interests, led by example as positive role models, and shared the tremendous career possibilities available to anyone in STEM fields. With incremental exposure to these elements, the stereotypes that have limited change are slowly wearing down.

In the following pages, Dr. Lynnette Madsen chronicles 100 remarkable engineers and scientists who have made lasting changes in the world. Some are designing technological solutions to the energy challenges, while others are pioneering more efficient ways to use natural resources. Each of these women is an exceptional example of why intentional leadership in science and engineering has never been more important than it is today.

The Faculty of Applied Science and Engineering at the University of Toronto is one of the top-ranked and most diverse engineering schools in the world. As Dean, I experience the benefit that involving multiple genders, ethnicities, and backgrounds brings to our campus and to industry. Multiple perspectives and multidisciplinary collaboration enhance creativity, which enables engineers and scientists to invent technologies and processes that have never existed before. These can become innovations that create prosperity today and ensure a bright future for the generations of tomorrow.

There has never been a more important time for Dr. Madsen's careful exploration into the professional and personal lives of these 100 trailblazers. Through a number of efforts that increase awareness of the rewarding careers in engineering and science among the public and students of all ages, as well as targeted recruitment efforts, many universities in Canada, the United States, and around rest of the world are experiencing record-high enrolment of female engineering and science students. Through similar strategic outreach initiatives and fostering engaging environments, the numbers of female graduate students and faculty members at these institutions are also on the rise.

The women you will read about in the forthcoming pages should inspire our momentum. Their stories should also remind us just how far we have to go. My intention is to see a world where gender is no longer among the defining features of a success story.

This is why I find Dr. Madsen's commitment to this effort extraordinarily inspiring—her research not only highlights the outstanding and tremendous contributions of female ceramic and glass scientists and engineers, but also gives greater visibility to the boundless potential of women in engineering, science, and beyond.

Each of us can be a catalyst in a girl's journey to science or engineering. Male or female, parent or educator, leader or peer, we each have the ability to illuminate and celebrate the difference women can make in the world through a career in these fields.

When I was growing up in Uruguay, I was fortunate to have several people who set their intention on seeing me reach my potential. First, it was a primary school teacher who encouraged me to “tinker” and take things apart. Then it was my parents who let me continue exploring, even when it meant finding our radio scattered in dozens of pieces across the living room floor. Later, it was a high school physics teacher who encouraged me to pursue engineering at the university level in Venezuela and, later, the United States. Many of these champions, mentors, and advocates were men. Intention sees possibilities through to change, regardless of gender.

Like the other engineers and scientists described in this book, incremental change, engagement, and influence from many different types of people lit my path to engineering. When evolving perceptions of what women could contribute to the field met the intention set by leaders and mentors in my life, it transformed my future. My career has taken me around the world, enabled me to pursue meaningful research, and eventually provided me the privilege and responsibility of leading change in higher education and in industry.

I am honored to introduce Dr. Madsen's book to you, and extend my deepest gratitude for her conviction and dedication to enhancing diversity. If we all join together in actions great and small, we can transform stones into sand, and sand into glass.

DR. CRISTINA AMON
*Dean, Applied Science and Engineering,
University of Toronto*

PREFACE

Mid-2012, I contacted Wiley about writing a book about women working with ceramics and glass. I wanted to focus on women because they are not only underrepresented in the physical sciences, but also underappreciated. Both of these factors have affected their success. I chose a narrow area of materials science and engineering to make a point—**there are plenty of successful women out there!** Underrepresentation is not the same as complete absence. However, those who have persisted in the field have been held to higher standards and encountered subtle and overt gender-based barriers. If I selected a broader category, it is likely that all of the top women in the materials science would have achieved many great awards or other recognitions already. For example, in 2012 alone, Prof. Mildred Dresselhaus was a co-recipient of the Enrico Fermi Award and was also awarded the Kavli Prize. Although some of the women featured in this book are members of prestigious organizations (e.g., U.S. National Academy of Sciences, U.S. National Academy of Engineering, the World Academy of Ceramics, etc.), others have yet to be included. Many of the women are still on the road to greater success and recognition. **It is my hope that by highlighting them in this book, it will aid in their journey.**

The difficult task was to *select* 100—not to *find* 100—notable women in ceramics and glass, and, at the same time, to get a *diverse* set of women—something I am familiar with in my day job as a Program Director at the National Science Foundation. Obviously, it was easiest for me to find U.S. women from academe—a group that I interact with daily, but my wish was for a broader cross section **to attract young women from around the world to the field and to encourage them to stay.** I want the reader to find someone in this book who reflects who they are and where they want to go. The women featured in this book have shared their career paths, life lessons or important turning points in their lives, what it has meant to be a woman in a nontraditional field, and some general advice.

It was challenging to simultaneously seek diverse women (in terms of geography, work sector, race/ethnicity, etc.) who worked to varying extents in one or more areas of ceramics or glass. Sometimes I found it difficult to appreciate women's careers when their websites were predominately in a language other than English. This limitation may account for the lack of women from some countries.

In the course of writing and selecting the 100 women to feature, I have left out many excellent women. When torn between several excellent choices, I gave a slight preference to selecting more senior women. So, the women in this book are merely illustrative, not exhaustive. Many others could and perhaps should have been included. I want to hear from you and your colleagues—I welcome your input for volume II, the next edition,

and/or other articles or books. To obtain a form for submitting a profile, e-mail me at Lynnette@svedbergscience.com.

Despite the number limitation, I think this book can still be considered a first resource for identifying successful women working in the field of ceramics and glass, dispelling the myth that there are no highly successful women in this exciting area of the physical sciences. Women are featured from all over the world, different sectors of the workforce, and reflect a diverse population. The book includes a rare view of women in industry who are less accessible than those in academe (who generally have work-related websites). The stories of these women come alive for the younger generation who seek role models and they remind the more senior populace that there are plenty of women in the field to consider when making nominations for honors, guest speakers, or awards.

LYNNETTE D. MADSEN, PH.D.

ABOUT THE AUTHOR

Dr. Lynnette D. Madsen was raised, educated, and worked for a decade in industry in Canada. Subsequently, she held a faculty position in physics at Linköping University in Sweden. Since 2000, Dr. Madsen has worked at the National Science Foundation (NSF) in the United States as the Program Director for Ceramics. In addition to recommending the distribution of the annual Ceramics Program budget, she has an active independent research program, led new cooperative activities with European researchers in materials, and been part of the driving force in program development and initiatives in nanotechnology, manufacturing, sustainability, education, and diversity. Also, she is Vice President of Svedberg Science, Inc.—a small business that provides consulting about scientific research directions and trends. This career trajectory has provided her with a bird's-eye view of the researchers in the ceramics and glass research field, which has informed the approach of this volume. More information about the author is available in her own profile, which appears later in this book.

QUICK GUIDE TO SELECT GROUPS

Many of the women featured are working in academe—they were the easiest to identify due to their publication records and university websites highlighting their work. Other career paths—at the onset of one’s career, or later on—can be equally rewarding and beneficial. I have highlighted two groups below.

Government and Nonprofit Organizations

Alida Bellosi (Institute of Science and Technology for Ceramic Materials, National Research Institute in Italy)

Zhili Chen (Communist Party of China)

Melanie W. Cole (Department of Defense)

Bonnie J. Dunbar (National Aeronautics and Space Administration (NASA))

Catherine P. Foley (Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia)

Carol M. Jantzen (Savannah River National Laboratory)

Sylvia M. Johnson (NASA)

Gretchen Kalonji (The United Nations Educational, Scientific and Cultural Organization (UNESCO))

Gabrielle G. Long (Argonne National Laboratory)

Lynnette D. Madsen (National Science Foundation)

Tina M. Nenoff (Sandia National Laboratory (SNL))

Julia Phillips (SNL)

Maxine Savitz (National Academies)

Debra R. Rolison (Naval Research Laboratory)

Inna G. Talmy (Naval Surface Warfare Center)

Ellen Williams (Advanced Research Projects Agency—Energy (ARPA-E))

Industry/Business

Uma Chowdhry (DuPont)

Dana Goski (Allied Mineral Products)

Lina M. Echeverria (Corning)
Katharine G. Frase (IBM)
Susan N. Houde-Walter (LaserMax)
Mareike Klee (Philips Research)
Merrilea Mayo (Mayo Enterprises)
Marina R. Pascucci (CeraNova)
Nelly M. Rodriguez (Catalytic Materials)
Eva M. Vogel (Bell Labs)
Wanda Wolny (Meggitt)

Despite the issues/obstacles in the United States, many of the women who are obviously successful in this field now reside in the United States; they account for about half of the women in this book. Nevertheless, women who are included represent 28 other countries.

Australia, Russia, and Asia

Inna P. Borovinskaya (Russia)
Rachel A. Caruso (Australia)
Helen Lai Wa Chan (Hong Kong, China)
Li-Chyong Chen (Taiwan)
Jen-Sue Chen (Taiwan)
Zhili Chen (China)
Catherine P. Foley (Australia)
Huey Hoon Hng (Singapore)
Kazumi Kato (Japan)
Michiko Kusunoki (Japan)
Jueinai R. Kwo (Taiwan)
Hua Kun Liu (Australia)
Soon Ja Park (Korea)
Tanusri Saha-Dasgupta (India)
Wei-Ying Sun (China)
Jackie Ying (Singapore)
Jing Zhu (China)

Europe

Alida Bellosi (Italy)
Serena M. Best (UK)
Dominique Chatain (France)

Ulrike Diebold (Austria)
 Alicia Duran Carrera (Spain)
 Natalia Dubrovinskaia (Germany)
 Mari-Ann Einarsrud (Norway)
 Monica Ferraris (Italy)
 Maria Veronica Ganduglia-Pirovano (Spain)
 Dagmar Gerthsen (Germany)
 Clare P. Grey (UK)
 Kersti Hermansson (Sweden)
 Gretchen Kalonji (France)
 Maarit Karppinen (Finland)
 Mareike Klee (The Netherlands)
 Marija Kosec (Slovenia)
 Anne L. Leriche (France)
 Claude Levy-Clement (France)
 Janina Molenda (Poland)
 Beatriz Noheda (The Netherlands)
 Ellen Ivers-Tiffée (Germany)
 Judith L. MacManus-Driscoll (UK)
 Tatiana A. Prikhna (Ukraine)
 Nava Setter (Switzerland)
 Nicola A. Spaldin (Switzerland)
 Paula Maria L.S. Vilarinho (Portugal)
 Wanda Wolny (Denmark)
 Maria Magdalena Zaharescu (Romania)

The Americas (excluding the USA)

Viola I. Birss (Canada)
 Linda F. Nazar (Canada)
 Ruth H.G.A. Kiminami (Brazil)
 Eliana N.S. Muccillo (Brazil)
 Noemi “Betty” Elisabeth Walsöe de Reca (Argentina)

Women of Color in the USA

Unfortunately, there are very few senior/accomplished women of color in the United States today with a glass or ceramics specialization to include in this book; the “pipeline” looks better.

Sossina M. Haile
Helen M. Chan
Deborah D.L. Chung
Uma Chowdhry
Lina M. Echeverria
Rosario Gerhardt
Nelly M. Rodriguez
Lourdes Salamanca-Riba

Women in Academe in the USA

The largest single group is women in academe in the United States. It was difficult to select individuals from the many excellent candidates. Some women are members of the National Academies, many are members of the World Academy of Ceramics, some are deans, and a few are past presidents of The American Ceramic Society.

Engineering and Applied Sciences (or closely related department)

Liesl Folks (University at Buffalo, SUNY)
Elsa Garmire (Dartmouth College)
Jennifer A. Lewis (Harvard University)

Materials Science and Engineering (or closely related department)

Dawn A. Bonnell (University of Pennsylvania)
Helen M. Chan (Lehigh University)
Elizabeth C. Dickey (North Carolina State University)
Mildred S. Dresselhaus (Massachusetts Institute of Technology)
Doreen D. Edwards (Alfred University)
Katherine T. Faber (California Institute of Technology)
Rosario Gerhardt (Georgia Tech)
Sossina M. Haile (Northwestern University)
Linda E. Jones (Alfred University)
Lisa C. Klein (Rutgers, The State University of New Jersey)
Waltraud M. Kriven (University of Illinois at Urbana-Champaign)
Alexandra Navrotsky (University of California, Davis)
Caroline A. Ross (Massachusetts Institute of Technology)
Della M. Roy (Arizona State University)
Lourdes Salamanca-Riba (University of Maryland)
Susan B. Sinnott (University of Florida)
Susanne Stemmer (University of California, Santa Barbara)
Susan Trolier-McKinstry (Penn State University)

Mechanical and Aerospace Engineering (or closely related department)

Emily A. Carter (Princeton University)

Deborah D.L. Chung (University at Buffalo, SUNY)

Optics & Photonics

Kathleen A. Cerqua-Richardson (University of Central Florida)

Physics (or closely related department)

Laura H. Greene (Florida State University)

Karin M. Rabe (Rutgers, The State University of New Jersey)

INTRODUCTION

Why This Book?

The book features 100 women scientists and engineers—all of whom were alive when the book was started.

In the Swedish newspaper, *Ny Teknik*, they described the most influential people in technology in Sweden; so herein, it was not merely the number of publications or citations that brought women to this book, but their positions of influence as well. Women included have at least one and typically several of the following attributes:

- Top recognitions, e.g., elected World Academy of Ceramic academician, elected U.S. National Academy member, winner of a prestigious international award or senior chair position, President of the American Ceramic Society
- A large number of citations (evident by a double-digit h-index)
- Positions of influence or international impact (e.g., astronaut, politician, etc.)
- Leadership, evident through a senior position held (or previously held) at a major company or organization
- Owner of a small business

Selection was not based on personal acquaintance, and in fact, I was “introduced” to many women through the process of writing this book.

The profiles hit a middle ground between the terse *Who's Who* format and a longer essay style. For most of the women featured, there are several pages of text with one or more images. Typically, each profile includes her affiliation, points of contact, a brief biography, an image of her active at her job, highlights of her successes (most cited publications, prestigious recognitions/awards, etc.), and many also include personal pointers to younger scientists finding their way.

For Whom?

The format I selected is based on how I pictured the book being used by the various readers. Many audiences, I envision five, will find the profiles in this volume to be useful.

1. **Women** (students of all ages, postdoctoral associates, new graduates, and mid-career professionals) **and people from other underrepresented groups** may draw inspiration and guidance from the profiles, and see a variety of career paths and options.

2. **Faculty advisors** (of students and postdoctoral associates) **and other mentors** will find this a useful book to share with their protégés (both female and male) to illustrate the diversity of career pathways available.
3. **Conference organizers and search and selection committees** (for awards, appointments, etc.) may use it to aid them in identifying women suitable for various opportunities. These opportunities in turn should enable women to showcase their research results, utilize their skills in new ways, and/or gain recognition for their successes. These profiles will help to overcome one of the challenges associated with the gender difference in professional networks: Women's networks are noted to differ in composition from men's—women's networks are broader in intellectual scope and may not be as instrumental for obtaining recognition in a specific field. Moreover, many women are conditioned to avoid seeking reward or recognition. On the other hand, I hope that committees will see this book as a tool to recruit and promote proactively. For this reason, points of contact have been provided for each woman.
4. **Professional and scientific societies**—both groups focused exclusively on women and organizations that are broader—will have a compilation of female role models.
5. **Professors and scholars of women's studies and/or gender studies** may find these profiles useful for the rich diversity of women in the field and insights about this group of successful scientists and engineers.

The Writing Journey

The idea comes in a flash—you see a way forward past the naysayers and doubtful... the idea is refined in hours to days as you consider what is out there in book form and available on the web. The dialogue with the publisher then takes days to weeks. The review of your book proposal takes additional weeks. Finally, the writing—including the background investigations and requests for additional information—takes months. As with any major endeavor one carries out as a “side activity” rather than vocation, this book evolved over quite some time from concept to reality. Key periods were particularly productive, e.g., during holidays around the end of the calendar year, and the 16-day Federal Government shutdown of 2013 (where I could not, by law, do any official government work until either a continuing resolution or budget was passed). During the government shutdown, the weather fully cooperated—we had several days of very hot weather (which limited what I wanted to do outside) followed by several days of rain . . . all in all, it was a very productive period for me.

The identification of the women and the collection of background information were done without the aid of Facebook or LinkedIn; I am not a member of either. Perhaps it would have been useful to join one or both of these, but I also thought it might also complicate things. As an added bonus, I didn't need to review their Data Use Policy and Statement of Rights and Responsibilities.

When Marija Kosec passed away in December 2012, in the period between the initial idea for this book and signing the contract, I made the decision to ask the oldest women first. And, for the most part, they are a tough group—while a few, e.g., Mildred Dresselhaus, had an extensive website (with sections geared for different age groups),